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Fishery Resources

Fish and Wildlife Service
U.S. Department of the Interior
FY 1977

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Illustrations of fish traps from INDIANS
OF THE NORTHWEST COAST by
Phillip Drucker.
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Introduction

The Fish and Wildlife Service of the U.S. Department of the Interior is the Nation's principal fishery conservation agency. The Service is responsible for the preservation and protection of fish and wildlife and their habitats on all public, interstate, Federal, and Indian lands. The primary role of the Service is to foster the wise use of fish and wildlife resources while at the same time managing and conserving these resources in order to provide continuous benefits to future generations. As part of the Fish and Wildlife Service, the Fishery Resources Program, in cooperation with the States and other Federal agencies, is dedicated to the restoration, improvement, and maintenance of the quality, use, and abundance of the Nation's recreational and commercial fishery resources.

The goals of the Fishery Resources Program are to:

- Establish, maintain, restore, and enhance fishery resources.
- Assure consideration of fishery resources in all Federal water projects.
- Aid States in the management and development of fishery resources.
- Control the introduction or spread of diseases and parasites harmful to fishery resources.
- Control the introduction or spread of exotic organisms damaging to fishery resources.
- Maintain an informed public and be responsive to the needs of the people.
- Promote a high level of competence and expertise among Service and non-service professionals.

Fish are evaluated in the field by stocking equal numbers of three to four strains of trout into lakes or impoundments with suitable water chemistry. The object is to produce strains best suited for specific managment needs.

Introduction

Activities of the Fishery Resources Program

The goals of the Fishery Resources Program are attained through a combination of six activities: fisheries assistance, fish production, fisheries research, grants, law enforcement, and construction. These activities are described briefly as follows.

Fisheries Assistance
The Fishery Resources Program provides assistance in fishery resource management for Federal, State, and Indian waters where such effort is needed or mandated to manage, conserve, and perpetuate fishery resources of importance to the national interest and the mission of the Service. Often, cooperative agreements for technical assistance are negotiated between the Service and other Federal and State agencies.

Fish Hatcheries
The Fish and Wildlife Service administers the National Fish Hatchery System, including Development Centers and a Hatchery Biologist Program, to meet priority requirements to support fisheries resources. The system produces and distributes species of fish of the size, number, strain, and quality needed to meet resource requirements for which the Federal Government is responsible.

Fisheries Research
The Fishery Resources Program conducts research responsive to the needs of Service wide fishery resource programs. Research also responds to needs of international groups, other Federal agencies, Indian tribes, State agencies, and private groups.

Grants
The Service participates with the National Marine Fisheries

Fisheries research is conducted to meet a variety of fishery resource needs. Reservoir research includes studies of spotted bass behavior. A biologist-diver films spotted bass spawning in Bull Shoals, Arkansas.

Service in the Anadromous Fish Conservation Act Program. The goal of this program is to restore depleted anadromous fish stocks and their habitats by enhancing existing populations and by creating new anadromous fisheries. This is achieved by matching State funds with Federal funds. A table of the distribution of Anadromous Fish Conservation Act funds and a compilation of project titles and description of anadromous fish projects by state are appended to this report.

Law Enforcement
Enforcement of Federal laws pertaining to fish is directed at international, interstate, and Indian-related activities. The Service also enforces State laws pertaining to fish when these laws are detailed in cooperative agreements or directed by court mandate.

Construction and Engineering
The Division of Engineering, working with the Division of Fish Hatcheries, Research, and the regional offices, develops project proposals and cost estimates for construction, maintenance, and repair of fishery facilities.

Fishery Resources Program Areas

The activities of the Fishery Resources Program are performed in three related program areas—coastal anadromous fisheries, inland fisheries and reservoirs, and the Great Lakes fisheries.

Coastal Anadromous Fisheries

Many of the most important commercial fish species are anadromous: the adults migrate from the sea upstream to spawn in fresh water. Often, migrating fish species such as Atlantic salmon and chinook salmon along the Pacific Coast encounter great difficulties during migration, such as dams and impoundments, polluted streams, and low water levels.

Measures to protect these fish during migration, spawning, and early growth are very important if continued benefits to fishermen are to be ensured. Fishery resources activities of assistance, production, and research are integrated to help solve some of these problems.

A good example of this integration is the salmon fishery of the Columbia River System. Salmon migrate up the Columbia River, finding their way back to smaller streams to spawn. Some of these tributary streams are located on Indian reservations. Fisheries assistance is provided on these reservations to protect and preserve this fishery. In order to identify Columbia River anadromous fish stocks, researchers are also marking migrating fish with biochemical genetic identifiers, and are using a computer model to estimate the contribution of separate salmon populations to the mixed stock fishery of the Columbia River System.

Introduction

Great Lakes Fisheries
Fishery resources activities are also important to the Great Lakes fishery. Formerly, the Great Lakes provided some of the country's best commercial and recreational fishing, but overfishing, pollution problems, and predation by the sea lamprey nearly decimated lake trout populations and other resident fish species. The Great Lakes Fishery Commission, created to restore and improve the sport and commercial fisheries of the Great Lakes, contracts with the U.S. Fish and Wildlife Service for sea lamprey control. Lamprey control consists of monitoring adult and larval lamprey populations, and chemical treatment of the larval stage. Research is investigating chemicals to reduce lamprey populations and is producing artificially sterilized adult lampreys which are released into the lake to compete with normal lampreys for mates. Fish production is devoted to restoring populations of lake trout, sauger, and other recreational and commercial fish species into these lakes and providing information on diseases affecting these species. Together, these efforts seem to be working. In 1977, natural lake trout reproduction was observed in Lake Michigan for the first time since the program began. The Great Lakes now support a commercial fishery worth $100 million and a recreational fishery valued at nearly $350 million.

Inland Fisheries and Reservoirs
In terms of the area covered and diversity of habitat, the largest segment of the Fishery Resources Program is Inland Fisheries and Reservoirs. This program deals with rivers, lakes, streams, ponds, and reservoirs on both Federal- and State-owned and managed lands, including: military bases, Veterans'

Administration hospitals, national parks, national forests, national wildlife refuges, Indian reservations, and cooperative Federal-State areas. Assistance in these areas covers every aspect of fish culture and management, from stocking of hatchery-reared fish to collection of wild broodstock and eggs, from rehabilitation of polluted streams to reestablishment of endangered species into these streams. Assistance includes training Indians in all aspects of fishery management and advising tribal organizations on their fishery resource management plans. Fish production includes warm-water, cool-water, and cold-water species, from smallmouth bass and channel catfish to rainbow trout and coho salmon.

Investigational activities for inland fisheries concentrate on new and improved fish cultural methods, diagnosis and treatment of disease, and evaluation of various fish strains to determine which strains will do best in given cultural conditions.

Left: *Cooperative Federal-State fisheries management often occurs on large Corps of Engineers reservoirs*

Regional And Area Office Organization

The Fishery Resources Program activities are part of the overall Fish and Wildlife Service efforts in each of six regional offices, and the Alaska area office. The Service manages these and other activities and projects through the regional, area, and field offices that are dispersed throughout each region.

Area offices and field offices within each region were set up to bring the decisionmakers closer to the people whom they serve. The map in the appendix shows the regional geographic boundaries, and locations of regional, area, and field offices, and national Fish Hatcheries.

Accomplishments for the Fishery Resources Program for FY 1977 are reported under the activities of fisheries assistance, fish hatcheries, and fisheries research. Accomplishments of the program areas of Coastal Anadromous Fisheries, Great Lakes Fisheries, and Inland Fisheries and Reservoirs are included under each of the above activities. Engineering and construction accomplishments are presented as a separate section at the end of the report.

sturgeon egg mashers

sturgeon club

Fisheries Assistance

Coastal Anadromous Fisheries Program

Fisheries assistance projects on coastal anadromous fisheries are undertaken to collect information and baseline data on spawning and habitat requirements of anadromous fishery resources. These projects include:

- Collecting information on fishery resources such as distribution and abundance, migratory patterns and habits, delineation of spawning and nursery areas, evaluation of spawning success, surveys, and inventories.
- Preparation of fishery management plans based upon these data for Indian reservations, wildlife refuges, national parks, national forests, military installations, river basins, and other areas.
- Collecting wild broodstock and eggs for hatchery or research purposes.
- Stocking hatchery-produced anadromous fish species into Federal waters.
- Training native Americans on fish culture and management techniques.

One of the primary functions of fisheries assistance is to produce data for assessing the anadromous fish stocks to determine management needs. When such a need is identified, collected information will be used to initiate development of management plans that ensure fishery resources protection. Accomplishments in this program for FY 1977 are described below.

Distribution and Abundance of Anadromous Fish in Florida

The purpose of this study, begun in 1976, is to provide information on the anadromous fishery resources of the Apalachicola River Basin, Florida, prior to basin development. Random sampling was done by gill net, haul seine, and trawling to determine the distribution and abundance of anadromous fish stocks in the Apalachicola River System.

Anadromous fish of 7 inch size and larger were tagged and released to provide information on seasonal movements and extent of range within the basin. Tag return information was obtained from cooperating sport fishermen and by recapture by project personnel.

The results of these continuing studies show that at present there is a limited anadromous resource in the Apalachicola River System. The sampling showed relatively few anadromous fish, particularly striped bass, and no evidence of striped bass spawning in the system at all. However, there is evidence of sturgeon, skipjack herring, and/or Alabama shad spawning in the system.

Evaluation of Stocking Success

A microtagging operation was carried out by the Fisheries Assistance Office, Olympia, Washington, using a mobile trailer unit that contains four tagging stations. Some 1,407,000 Pacific salmon and steelhead trout were microtagged as part of a continuing program of integrated stock assessment and stocking evaluation to achieve maximum effectiveness and efficiency from Federal stocking, while minimizing or eliminating detrimental impacts on native fish stocks.

Indian Rights to Roe-Herring Fishery Upheld

A Federal Court decision on treaty fishing rights determined that Indians were entitled to a share of the roe-herring catch. The formula for sharing is 40 percent to non-Indians, 40 percent to the off-reservation Indian fishery, and 20 percent to the Lummi tribal on-reservation catch. During the past three years, the total harvest has averaged about 2,800 tons worth approximately 1 to 12 million dollars. Fishery resources personnel, in cooperation with the affected Indian tribes, the Washington State Department of Fisheries, and the National Marine Fisheries Service, conducted spawning ground and acoustical biomass surveys to assist in managing the court-decreed roe-herring allocation. Fisheries assistance personnel are preparing a final report summarizing these studies. The report appraises the strengths of the major Puget Sound herring stocks and discusses the unlikelihood of herring populations supporting new Indian sac-roe fisheries. It is hoped that all field work on herring can be turned over to the tribes in 1978.

Fisheries Assistance

Coastal Anadromous Fisheries Program

Sockeye Salmon Decline Studied

A cooperative study between fisheries assistance personnel, U.S. Geological Survey, Washington Department of Game, University of Washington, and the Makah Indian Tribe was begun to determine causes for the drastic decline of the sockeye salmon run to Lake Ozette. Lake Ozette is the third largest natural lake (7,787 acres) in the State of Washington and is located on the Olympia Peninsula. The sockeye run was estimated at 30,000 fish in the early 1950's and today is probably less than 1,000 fish. The study will take 2–3 years, with activities in 1977 representing the reconnaissance phase.

Monitoring Indian Fisheries in Washington State

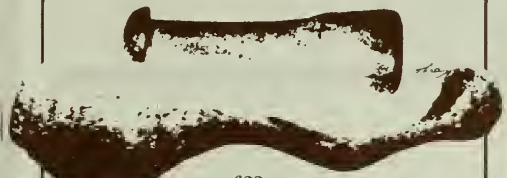
In cooperation with the various tribes that fish in the Columbia River, fisheries assistance personnel in Vancouver initiated a program to monitor the Indian subsistence fishery. Assistance was given to the Yakima tribe in monitoring their subsistence fishery on the Klickitat River. Technical assistance and routine analysis of the Columbia River fish runs were provided to the four Columbia River treaty tribes, the Columbia River Inter-Tribal Fish Commission, and the Bureau of Indian Affairs. At the request of the Yakima tribe, a contract was made with Washington State University to conduct a study to identify anadromous fish movements in the Yakima River. The final report, "Hydraulic Characteristics of the Yakima River for Anadromous Fish Spawning," contains information on the spawning and rearing habitat available to anadromous fish under varying flow conditions. The study was expanded in 1977 to include Satus and Toppenish Creeks, tributaries to the river, and an additional report will cover these two areas.

During 1977, personnel from the Fisheries Assistance-Marrowstone field station obtained information on existing or potential pollution problems at 25 tribal areas. Pollution problems which could have an effect on Indian salmonid or shellfish fisheries were surveyed both on and off reservations. Concern was greatest over the effects of siltation, stream blockage, bacterial problems, and low water flow on the fisheries.

White Sturgeon Populations Studied

A study of white sturgeon populations in the Columbia River at Bonneville, The Dalles, and John Day Pools, initiated during 1976, continued during the year. Sturgeon populations and migration patterns are being studied through a tag and recovery program. The tagging phase, in Bonneville Pool, was completed during the year with the tagging of over 1,250 sturgeon. During the tagging operations, bone samples were obtained from more than 500 sturgeon to obtain age to length/weight relationships, and the general age structure of the populations.

During the 1977–1978 salmon and steelhead runs, the Fisheries Assistance Office in Olympia, Washington, cooperated with the Washington State Departments of Fisheries and Game and the Nisqually, Muckleshoot, Lummi, Nooksack, Swinomish, Sauk-Suiattle, Upper Skagit, Skokomish and Squaxin Tribes in population studies on selected Puget Sound streams. Objectives were to enumerate run size and escapement. These baseline inventory studies use jaw tagging on a sample of the adult run in estuarine areas, with subsequent enumeration of tagged and untagged fish in the fisheries and on the spawning grounds. Integrated final reports on the individual studies covering a minimum three-year period for each stream or drainage will be published when the studies are terminated.


egg mashers

Radio Tracking of Atlantic Salmon Smolts Provides Information

Radio transmitters were used by Service fisheries biologists to track 42 Atlantic salmon smolts in the Connecticut River System. These fish, progeny of an experimental crossing of landlocked and sea-sun stocks in Vermont State Hatcheries, were found to have the necessary out-migrating behavior of the sea-run parent. One smolt was shown to have traveled 150 miles downstream in 19 days, passing over spillways or through the electrical generating facilities of three major Connecticut River dams ranging in height from 32 to 36 feet.

Atlantic Salmon Restoration Plans Near Completion

An Atlantic salmon restoration planning effort for New England waters began in January 1977. Headquarted in Laconia, New Hampshire, the overall plan will incorporate existing Connecticut River, Merrimack River, and Maine rivers restoration plans. Strategic plans for each of the separate management areas are in various stages of completion and each will undergo general review and comment by cooperating agencies in mid-1978.

Surveying Alaskan Salmon Streams

Biologists of the Kenai fishery resources staff assisted the Alaska Department of Fish and Game in sampling two Kenai Peninsula red salmon spawning areas on tributaries of the upper Tustumena and Upper Russian Lakes.

salmon clubs

Assistance was also provided for the annual installation of a weir at Lower Russian Lake used to monitor the largest run of sockeye salmon on the Kenai Peninsula. A study to determine steelhead trout activity in various streams in the southeast area was initiated by fishery resources and Alaska Department of Fish and Game biologists during the first week of May. Twenty-five streams were surveyed during a two-week period in July by the FWS Ketchikan staff, in cooperation with the U.S. Forest Service, to determine species composition of fish in streams on Prince of Wales Island. Species found in 13 of the 25 streams surveyed included coho salmon, cutthroat trout, and Dolly Varden trout.

Fisheries Assistance

Coastal Anadromous Fisheries Program

Inventory and Assessment of Native Fish Stocks

Since 1969, the Service has conducted an ongoing fisheries program on the Hoopa Valley Indian Reservation on the Trinity River, California. An assessment and inventory is presently being conducted of native spawning stocks, spawning and rearing habitats, fish migration barriers, water diversions, spawning success and recruitment in major streams on the reservation. A long-range restocking plan is also being developed.

American Shad Workshop Conducted

The Fish and Wildlife Service and the National Marine Fisheries Service cohosted a workshop on American shad at Amherst, Massachusetts, in December 1976. Various presentations addressed the status of shad stocks on the Atlantic coast, factors affecting abundance and distribution of the species, coordination of research activities, and the exchange of information. The proceedings were published in 1977 by the Government Printing Office. Copies are obtainable from the regional office in Newton, Massachusetts.

Participation in The Presidential Task Force on Northwest Fisheries

Fishery resources staff have participated with the Regional Team of the Presidential Task Force on Northwest Fisheries in a review of proposed enhancement projects for sport and commercial fisheries. Data were also provided for a computer model used in evaluating enhancement proposals submitted to the Task Force. Fisheries assistance also supplied a summary of Indian harvest data for 1977 by tribe, including an economic analysis of tribal fishermen gear needs. The

office prepared a document entitled, "Problem Statement, Salmon and Steelhead Freshwater Habitat, Puget Sound and Olympia Peninsula," constituting an overview of habitat requirements of anadromous salmonids, habitat degradation, State and Federal protection legislation, policy framework formulation, and forms of policy.

Fishery Management Plan for the Columbia River

In 1977, the Fisheries Assistance Office in Vancouver provided information and assisted in negotiations involving a court order by Judge Belloni. "A Plan for Managing Fisheries on Stocks Originating from the Columbia River and Its Tributaries Above Bonneville Dam" was signed by Judge Belloni on February 28, 1977. The plan is designed to use sound biological principles for protecting the resource while allocating surplus fish destined for above Bonneville Dam to the Indian and non-Indian fisheries.

Alaska Native Community Fisheries Assisted

The Ketchikan fishery resources staff provided fishery assistance to the natives of Annette Island, Alaska, until May 1976, at which time the Ketchikan field station acquired a full-time fisheries biologist who worked exclusively on community projects. The Metlakatla Indian community is presently constructing a new hatchery on Tamgass Creek and recently hired a full-time tribal biologist. Fisheries assistance to the Indian community has been that of providing only occasional technical assistance to the community and their biologist as requested. A fishery management plan for Annette Island will be completed by the end of FY 1978.

Transport of Yakima River Chinook Salmon Succeeds

In 1977, low water conditions resulted in severe passage problems for anadromous fish in the Yakima River. The U.S. Fish and Wildlife Service, in a cooperative effort with the Yakima Tribe and the Washington Department of Fisheries, trapped and transported adult and juvenile spring chinook salmon in the Yakima River above and below drought-created obstacles to free passage areas.

Sacramento River Salmon Salvaged

Emergency measures were taken by the State of California and Federal agencies in 1977 to salvage the upper Sacramento River salmon run. The major effort was centered at the Red Bluff Diversion Dam where facilities are available for collection and redistribution of adult salmon. A limited trapping and redistribution of spring chinook salmon took place during April through June. Commencing with the fall run of chinook salmon in September, all salmon were collected that were destined to migrate above the Red Bluff Diversion Dam. During the next 4 months, approximately 22,000 adult salmon were hoisted into a fleet of Federally-owned and manned trucks and transported to the State's Feather River Hatchery, the Coleman National Fish Hatchery, and Battle Creek and Tehama-Colusa spawning channels.

Fisheries Assistance

Coastal Anadromous Fisheries Program

Barges Used to Transport Fish

To alleviate downstream fish losses at Columbia River Dams, the Army Corps of Engineers, in cooperation with the National Marine Fisheries Service (NMFS), proposed, developed, and put into effect "Operation Fish Run." The Corps and NMFS designed a large river barge that carries two large distribution tanks. The tanks are capable of holding 50,000 pounds of smolts. The barging technique was successful and had several advantages over the trucking: (1) less stress is placed on the fish, and (2) homing instinct is not jeopardized since the barge utilizes river water in the aeration process.

Salmon and Steelhead Stocked in Management Programs

During 1977, Fisheries Assistance in Olympia, Washington, coordinated the stocking and/or allocation of slightly more than 17 million (638,400 pounds) salmon and steelhead smolts and nearly nine million salmon eggs. Tribal requests for chum salmon eggs exceeded 29 million and attest to the rapidly expanding gravel incubation and rearing facilities in the area. Several meetings were held to review these programs with the tribal and Washington State Department of Fisheries personnel to coordinate efforts in utilizing proper stocks and to consider impacts on future harvest management programs.

Training Activities for Native Americans Continue

Many of the activities undertaken by the Fishery Resources staff as part of fisheries assistance are intended to prepare Indians to manage their own fishery resources. Training can include seminars on fish diseases for tribal game wardens, workshops on identifying fish for Indian fishermen, or more formal training as biological aides. Indians participate in nearly all aspects of fishery assistance on and off reservations, and in many areas fishery management has been taken over completely by these trained native Americans. Training activities include all the activities normally undertaken as part of fishery assistance, fish production, and research.

For example, tribes often request help in monitoring spawning runs and subsistence fisheries on reservation waters, gathering data that later provide the basis for the development of fishery management plans. These plans are then carried out by the tribal organizations with limited help from fishery resources. As problems are encountered, more specific training is given. Training activities in fish culture and management are usually given at national fish hatcheries, development centers, and research laboratories.

Fisheries Assistance

Great Lakes Fisheries Program

Fisheries assistance projects of the Great Lakes fisheries are undertaken to stock lake trout into treaty waters, to provide assistance in the control of the sea lampreys by monitoring population levels and undertaking an active eradiction program, and to provide technical assistance and advice to Indian tribes bordering the Great Lakes in the management of their fishery resources and protection of spawning areas. In these activities, fisheries assistance personnel work very closely with fish hatcheries and research.

Many assistance projects are part of programs undertaken at hatcheries and research facilities. These projects are described below.

ottawa beaded bag depicting underwater panther

Sea Lamprey Control Projects Continue

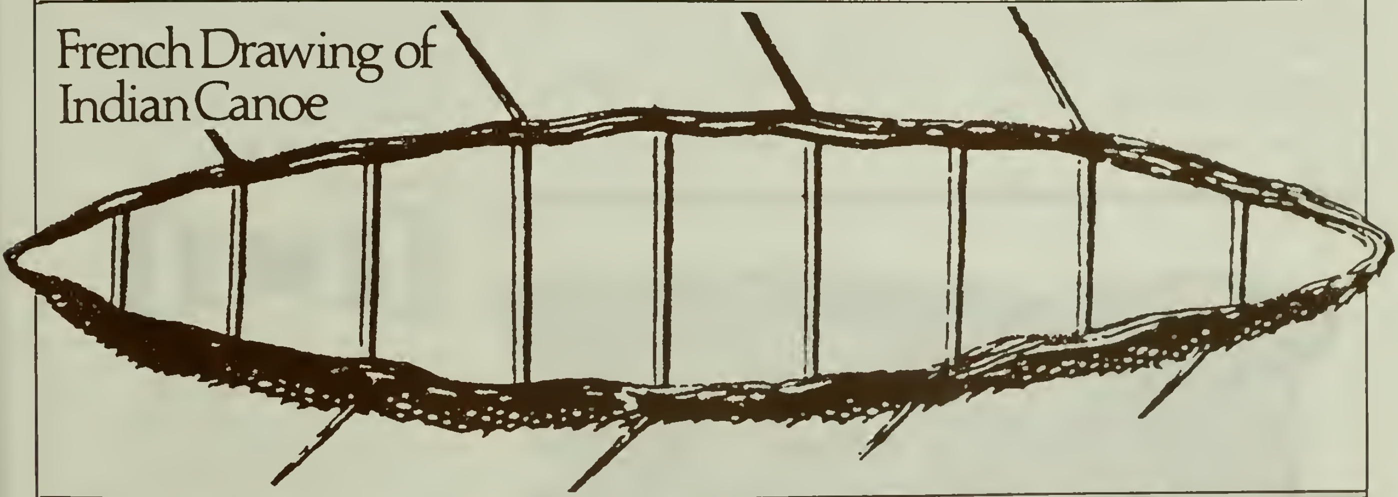
The core of the Great Lakes Fisheries Program is the sea lamprey control project whose objective is to reduce sea lamprey populations in the Great Lakes to a level that permits optimum fishery survival and productivity.

The Service, as the U.S. agent for the Great Lakes Fishery Commission, conducts sea lamprey control through the fisheries assistance activities. Included are surveys to determine the presence and distribution of lampreys in streams, application of lampricides to streams to destroy larval sea lampreys, and studies of phases of the lamprey life history.

Substantial progress was made in stream treatments during FY 1977. Chemical treatments were completed on 75 tributary streams: 24 on Lake Superior, 37 on Lake Michigan, and 14 on Lake Huron.

Surveys to assess sea lamprey populations were conducted on 310 streams tributary to the Great Lakes. Sea lamprey larvae were found for the first time in seven of these streams. Because of the pollution abatement activities taking place in the Great Lakes, stream habitat has improved and many streams will now support lamprey populations that would not in the recent past.

In addition to survey and treatment activities, eight electric assessment barriers on Lake Superior and one on Lake Huron were operated to assess trends in migrating adult lamprey populations. No significant changes in the population levels were found. Overall, it appears the lamprey population is being maintained at less than 10 percent of the peak population of the early 1960's.



French Drawing of Indian Canoe

Fisheries Assistance

Great Lakes Fisheries Program

Fish Culture and Management Assistance Given to Tribes

The Ashland Fishery Assistance Station, Wisconsin, provides management assistance to the Bad River Indian Reservation in northern Wisconsin on the walleye spawning runs in the Bad and Chequamegon Rivers. These runs support the walleye population in the Chequamegon Bay area of Lake Superior. The walleye runs have declined in recent years. Assessment information indicates the presence of strong upcoming year classes, providing possible evidence that the population is recovering. Ashland personnel also provided advice to the Bay Mills Indian Tribe in development of a tribal conservation code and regulations to protect the resources and control harvest of tribal fish resources in Whitefish Bay of Lake Superior. This code has been adopted by the Tribal Conservation Committee.

ottawa beaded bag depicting underwater panther

Experiment to Establish Chinook Salmon Continues

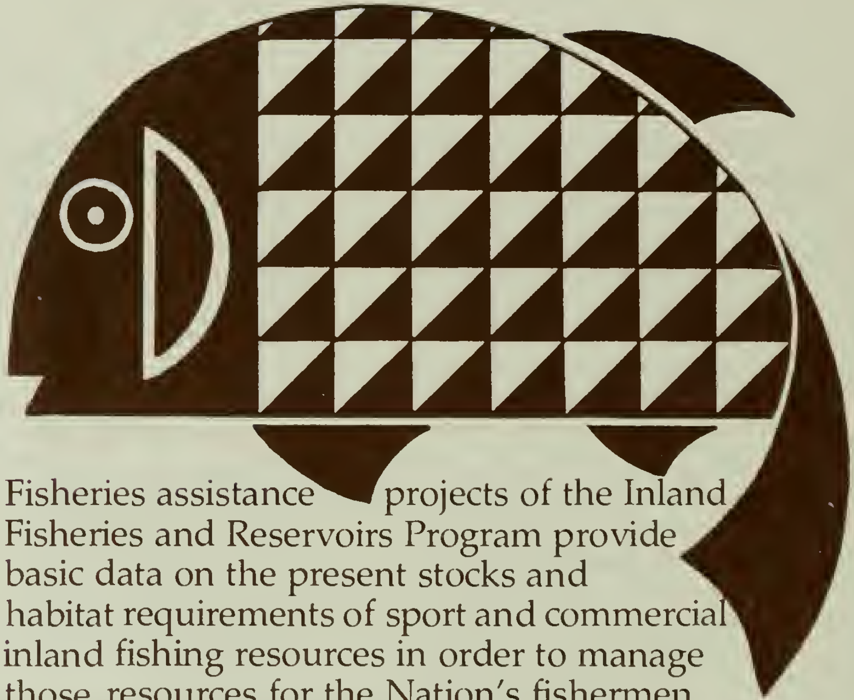
The Bemidji Fishery Assistance Station in Minnesota continued a program to establish a chinook salmon run on the Grand Portage Indian Reservation on the north shore of Lake Superior. This three-year State-Federal cooperative experimental program is an effort to increase the sport fishing opportunities in Lake Superior waters near the Grand Portage Indian Reservation.

Lake Trout Stocking Continues in Great Lakes

In FY 1977, 4.5 million lake trout were produced for stocking in Lakes Superior, Michigan, and Huron. In addition, over one-half million lake trout were produced through a cooperative agreement with the State of New York under which the Service provided rearing facilities and manpower, and New York provided funding for fish food, marking (fin clipping), and distribution.

Fisheries Assistance

Inland Fisheries and Reservoirs Program



Fisheries assistance projects of the Inland Fisheries and Reservoirs Program provide basic data on the present stocks and habitat requirements of sport and commercial inland fishing resources in order to manage those resources for the Nation's fishermen. These projects include:

- Collection and analysis of data through the use of surveys, inventories, creel censuses, limnological studies, water quality monitoring, and tagging that provide information on inland fishery resources.
- Preparation of fishery management plans for Indian reservations, wildlife refuges, national parks, national forests, military installations, river basins, and other areas.
- Distribution of hatchery-produced and reared fish into tribal, Federal, and State waters.
- Preparing and presenting information on fishery resources and environmental impacts of development upon those resources for legal decisions and environmental impact assessments.
- Training native Americans in fish culture and management techniques.

Inland fishery resources constitute a major portion of the Nation's recreational fisheries. Information is needed on distribution and abundance of fish populations within streams, migratory patterns and habits, delineation of spawning and nursery areas in streams, and evaluations of spawning success. Some studies are designed to determine the standing population of fish, or monitor water quality and its influence on spawning and hatching success. Biological and physical data gathered and analyzed are used for the development of management plans, for providing background biological information for environmental impact assessment, and for determining the need for management of a fishery resource. Projects in these categories are described below.

Sampling stream benthos on Cut Bank Creek, Montana, provides fish management information for the Blackfeet Indian Reservation.

Fisheries Assistance

Inland Fisheries and Reservoirs Program

Cooperative Project on Lahontan Cutthroat Trout Continues

Field investigations are being carried on to determine the feasibility of reestablishing natural spawning by Lahonton cutthroat trout and cui-ui in the Truckee River, and establish the river flow necessary to protect these populations and the fishery of Pyramid Lake. The various studies, designed to provide technical information in the Truckee River fishery area, were initiated in 1975 as a cooperative project between the Bureau of Indian Affairs, Pyramid Lake Paiute Tribe, California Department of Fish and Game, the Nevada Department of Fish and Game, and the U.S. Fish and Wildlife Service to provide for litigation on Indian treaty water rights for fishery purposes in the Truckee River.

Field work on two carry-over projects from 1976 was completed during the year. Results of fyke netting of juvenile Lahonton cutthroat trout indicate that these fish migrate in the fall rather than in the spring. In a related study, 25 adult cutthroat were tagged with radio transmitters and released into the Truckee River to determine if spawning adults released above any possible imprinting source would use tributary streams. Due to erratic weather conditions, the results are inconclusive.

An intensive creel census on the Pyramid Lake trout fishery was completed in 1977. The study is a cooperative effort of fisheries assistance personnel and the Pyramid Lake Paiute Tribe. Indications are that the catch rate has increased substantially, possibly as a result of increased hatchery production. Micro-tagged Lahontan cutthroat trout are beginning to enter the sport fishery in Pyramid Lake as well. Data collected will help to determine: optimum size for stocking, mortality, effect of location on development of spawning runs, and the strain of fish that produces the greatest angler return.

Disease-Resistant Fish Studied

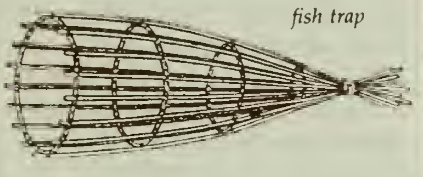
A creel census was conducted during the year on major trout fishing areas on the Warm Springs Reservation, Oregon. Data collected on Lake Simtestas showed that stocking the lake with less fish than in previous years, but with *Ceratomyxa shasta*, resistant fish did not significantly change the catch per hour of effort. Gill net surveys indicated a good survival of the disease-resistant fish as compared to the 1976 surveys when no trout were caught.

Proposed Hydroelectric Site Surveyed at Lower Mahoney Lake, Alaska

The fishery resources staff, in cooperation with Southeast Alaska Ecological Services, conducted a preliminary survey of a proposed hydroelectric site, located 16 miles southeast of Ketchikan. Field data collected from the 160-acre Lower Mahoney Lake will be used to evaluate impacts of the proposed project. Analyses were conducted to determine water quality, and species composition was determined by use of electro-fishing gear and experimental gill nets.

Sport Fishery Potential Examined at Tyonek, Alaska

A fishery management survey was completed on selected lakes and streams located on land owned by the native village of Tyonek. The purpose of the survey was to examine the feasibility of establishing a sport fishery in the area and providing an additional income base for the village by attracting anglers from metropolitan areas. A survey report is currently being prepared.



willow fish trap

Fishery Management Continues on Tinker Air Force Base

Three ponds on Tinker Air Force Base, Oklahoma, are serviced by fishery resources personnel. The three ponds receive heavy angler use. Fishery resources staff assisted base personnel in planning the enlargement of an existing pond. Fishery surveys were conducted to determine total fish populations, limnological conditions, and fishing pressure. Partial rotenone treatments to control fish and several spot applications of herbicides to control aquatic vegetation were made.

Trapping exotic longnose suckers at Pelican Creek fish trap in Yellowstone National Park.

Weirs and Traps Provide Information for Yellowstone Park

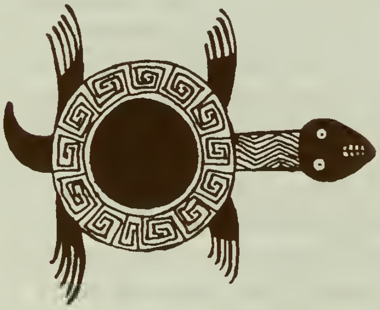
Work on Yellowstone Lake during FY 1977 included the operation of weirs and fish traps on Pelican, Clear, and Cub Creeks, with both upstream and downstream runs enumerated. The exotic longnose sucker spawning run on Pelican Creek was destroyed for the second consecutive year. Annual gill netting of Yellowstone Lake was accomplished to evaluate effects of regulation changes, population trends, and sucker destruction. A limnological study to evaluate the effects of the 1976 Divide Fire on the South Arm of Yellowstone Lake was continued. An ecological study was initiated on Slough Creek in response to National Park Service concern over possible future mining activities in the headwaters area. Preliminary baseline limnological data were collected monthly from Lewis Lake due to its position in a "let-burn" zone and the high frequency of lightning strikes in the drainage. The data will be used in the future to study the effects of fires on the aquatic system. Progress continued on a stream invertebrate study to determine effects of fish populations on species composition and abundance.

Fisheries Assistance

Inland Fisheries and Reservoirs Program

Impacts of Coal Development Studies

Coal development planned for southeastern Montana could have an adverse impact on Rosebud Creek, a principal stream on the Crow Indian Reservation that contains wild brook trout in its upper reaches and northern pike in its mid and lower reaches. The fishery resources staff has increased baseline studies of the entire Rosebud Creek Drainage Basin.



Greenback Cutthroat Trout Recovery

During FY 1977, fishery surveys were conducted within Rocky Mountain National Park in conjunction with the Greenback Cutthroat Trout Recovery Plan. Two surveys were concerned with success of greenback introduction, and one survey was conducted to determine new areas for greenback transplant. One creek was found to contain a good population of greenbacks originating from fish stocked in 1973. Unfortunately, all brook trout were not removed and appear to be expanding in number, although they are still in a limited area. No greenbacks were found in one of the lakes that was renovated and stocked.

Preparation of Management Plans for Tribes Continues

The management of inland fishery resources depends upon the development of fishery management plans based on data collected through surveys and inventories by fisheries assistance personnel. Fishery resources staff assist in the preparation of fishery management plans for and in conjunction with Indian tribes, wildlife refuges, national parks, national forests, military installations and other areas not managed by State agencies. Some management plans developed include those initiated on ten reservations in Wisconsin and Michigan, and the Bay Mills Indian Tribe at Whitefish Bay, Michigan.

Chippewa Flowage Plan Presented at Hearing

The Ashland fishery resources personnel presented testimony to the State of Wisconsin Natural Resources Board and the Federal Power Commission relative to the claim for the Chippewa Flowage by the Lac Courte Oreilles Band of Chippewa Indians. A fishery management plan for the flowage was presented to the court and questions regarding the plan were answered by fishery resources staff.

Colorado River Fishery Management Plan Prepared

Fishery resources personnel have nearly completed the fishery management plan for the Colorado River Indian Reservation and have initiated a special study of the (Colorado River) Parker Diversion project. The management plan—in initial draft form—will be completed by 1978. The special study on the Colorado River is a coordinated effort between the Colorado River tribes, the Service, and the California Fish and Game Department.

Woundfin Recovery Plan Near Completion

Fishery resources staff members served on the Woundfin Recovery Team during 1977. Activities included regular monitoring of the endangered woundfin (a spiny rayed minnow) populations in the Virgin River, Utah, and near completion of the Woundfin Recovery Plan. The Recovery Plan for this endangered fish species will be completed and submitted to the Fish and Wildlife Service in early 1978.

Glacier National Park Fishery Planning Underway

A formal agreement for fishery investigation was drawn between Glacier National Park and the Service during FY 1976. Cooperative funding was instituted to develop a mutually acceptable Glacier Park fishery investigation plan during FY 1977. Twelve fishery habitat cross-sections were analyzed for waters of Glacier National Park within the North Fork, Flathead River watershed. Information pertaining to physical stream habitat, aesthetics, stability, water quality, aquatic insects, and fish populations was gathered from 11 west-slope tributary streams. This habitat analysis is being coordinated with 1976–1977 Flathead Drainage 208 and Montana Fish and Game Department investigations of the tributary streams of the Flathead National Forest. In 1977, fishery surveys included Kintla, Bowman, Logging, and McDonald Lakes and the North Fork of the Flathead River.

Fishery Management Plans Completed for Seven Tribes

A major function of the fishery resources staff during FY 1977 was the preparation of comprehensive fishery management plans for Indian reservations. An interim fishery management plan for the Wind River Indian Reservation was prepared for use as a guideline on future management of fish and wildlife resources on the reservation. The plan includes goals of the project, problem areas, strategies, and funding levels required to complete project activities.

A draft Interim Fishery Management Plan for the Northern Cheyenne Indian Reservation was completed to serve as a guideline for operations. Fishery resources personnel also worked closely with the 208 Research Project in developing recommendations designed to improve existing water quality characteristics of reservation ponds.

The combined Assiniboine and Sioux Tribes have an active Land and Resources Committee that is presently pursuing a plan to establish a Tribal Fish and Game Program on the Ft. Peck Indian Reservation.

Fishery management plans were completed for the Crow, Flathead, Blackfeet, and Fort Belknap Indian Reservations. These plans include fisheries management history, program goals, and identification of problems in the use of the fishery resource on the reservations. Fishery Resources biologists continue to develop plans on a number of other reservations.

Work was initiated on the development of management plans for fishery and aquatic resources on a number of national wildlife refuges.

Fisheries Assistance

Inland Fisheries and Reservoirs Program

Rainbow Trout Stocked in Exchange Program

In 1977, approximately 32,000 catchable rainbow trout were stocked in Tule River Indian Reservation waters under the exchange program with the California Department of Fish and Game. The fish were stocked in biweekly allotments of 2,000 and 2,500 between April and October. For the third consecutive year, 3,000 rainbow trout fry were stocked into selected tributary streams in an attempt to develop natural populations to supplement the catchable-trout fishery.

Chinook Salmon and Trout Stocked at Colville Indian Reservation

During 1977, fisheries assistance personnel stocked five species of trout numbering 750,000 into waters of the Colville Indian Reservation, Washington. A similar number of spring chinook salmon were also stocked into Lake Roosevelt in an effort to produce a landlocked population. The Colville Tribe provided the manpower, and the the total cost of chemicals, fish food, and distribution.

Trout Stocked in California and Nevada Military Installation Lakes

In accordance with provisions of the Sikes Act (PL 86–797), stocking activities proceeded on one Nevada and two California military installations. The Hawthorne Naval Ammunition Depot in Nevada encompasses a portion of 38,000-acre Walker Lake, which is stocked annually with Lahontan cutthroat trout under a cooperative program with the Nevada Department of Fish and Game. Trout fishing is also maintained in two small water-supply reservoirs with periodic releases of rainbow trout.

In California, 22,000 rainbow trout were stocked at Beale Air Force Base and 3,000 at Dixon Naval Radio Transmitting Facility to provide recreation for installation personnel.

Salmon Stocking Continued on Grand Portage Indian Reservation, Minnesota

In cooperation with the Minnesota Department of Natural Resources, the Service began chinook salmon introductions in 1976 in an effort to make the sport fishing off Grand Portage Indian Reservation shores more attractive. The second stocking of 40,300 chinook was made in the summer of 1977. An evaluation of this stocking program will be made after three years of stocking.

Major Stocking Program Underway at Arizona Indian Reservations

The Colorado River Indian Reservation contains about 317 acres of lakes, 395 miles of canals and drains, and 57 miles of the Colorado River. Of that total, 9 lakes (194 acres), 6 miles of canals, and 44 miles of the Colorado River are currently being managed. During 1977, the Service planted 27,950 rainbow trout, 33,434 channel catfish, and 10,000 hybrid sunfish in reservation waters.

Managed fishery resources on the Fort Yuma Indian Reservation include 20 acres of the Yuma Main Canal and the forebay area of the canal. Nearly 95 percent of the reservation's 8,500 acres are in California and the remainder in Arizona. During the last three years, the Service has not been able to provide fish for the sport fishing program due to the disease policy of the State of California. However, clearance of Willow Beach National Fish Hatchery by the Colorado River Wildlife Council during 1977, enabled the Service to plant 3,000 catchable rainbow trout into reservation waters.

Restoration of Arizona Trout Continues

Most of the remaining populations of the threatened Arizona trout, *Salmo apache,* are found on the Apache Indian Reservation. Restoration of *Salmo apache* habitat is of prime importance. One portion of Ord Creek (holotype stream) was restored by eradicating brook and brown trout from the stream and reintroducing the resident population of Arizona trout. Several streams and two impoundments are included in plans for further restoration of this species and eventual delisting.

Right: *Threatened Arizona trout are being collected by electrofishing*

Fisheries Assistance

Inland Fisheries and Reservoirs Program

Reestablishment of Golden Trout Underway
Efforts to reestablish a pure strain of golden trout *(Salmo aguabonita)* in Bull Lake Creek drainage on the Wind River Indian Reservation, Wyoming, continued. For the second year, golden trout were planted by helicopter in four lakes in the Milky Creek drainage tributary to Middle Fork and Bull Lake Creeks. Planting of golden trout will continue in these waters in 1978 and 1979 to ensure successful introduction and an adequate gene pool. Once established, this unique species should have adequate spawning habitat for natural recruitment.

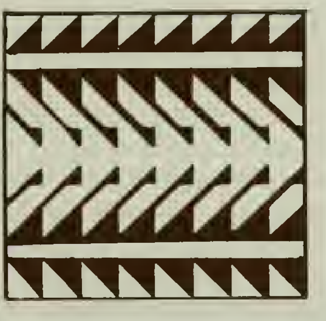
First Rainbow Trout Stocked in Kansas Waters
In 1977, rainbow trout were stocked in Kansas for the first time. A coordinated effort between the State of Kansas fisheries personnel, Cedar Bluff National Fish Hatchery, Hotchkiss National Fish Hatchery, and the Kansas City Area Office accomplished the stocking of 20,000 rainbow trout into Cedar Bluff Reservoir. The stocking will be evaluated by the State fishery biologists.

Reservoir Stocked for Patients at Salt Lake City Veterans' Administration Hospital
A fishing program for patients of the Salt Lake City Veterans' Administration Hospital was reestablished at Red Butte Reservoir, located in the Wasatch National Forest. The site was surveyed and then planted with 2,200 rainbow trout for the exclusive use of hospital patients.

Since the fish stocked were part of a special fish genetic study being conducted by the Service in an attempt to improve the overall quality of the hatchery product, they were marked with a fin clip, and the hospital staff will maintain catch records. This site will also be used as a test area for genetic evaluation of hatchery-produced fish.

Yellowstone National Park Cutthroats Transplanted
A rare form of the Yellowstone cutthroat trout, known only from one small stream, was the object of an active transplant program this year. In cooperation with the National Park Service and the Wyoming Game and Fish Department, the Service collected and transported by air approximately 500 adult and subadult Sedge Creek cutthroats to a previously barren stream in the Teton Wilderness Area (South Fork-Upper Yellowstone drainage). Similarly, a rare form of the Snake River cutthroat trout, the Heart Lake cutthroat, which has been identified as being vulnerable to extinction, was transplanted to Pocket Lake in Yellowstone Park.

National Pesticide Monitoring Program Activities Continue
Fish specimens were collected from three areas in Lake Superior for the National Pesticide Monitoring Program. Indian tribes were instrumental in collecting the necessary fish.



Biologists at Central States Fishery Station, Indiana, are collecting fish for pesticide analysis on the Wabash and Ohio Rivers. Station biologists also assist the Ohio River Valley Sanitation Commission in sampling fish populations in six lower Ohio River navigation locks.

The discovery of high pesticide concentrations within the aquatic ecosystems at Rocky Mountain Arsenal resulted in the suspension of the trout stocking program for those waters. Although fishing is allowed, the fish must be released. A study is continuing to document pesticide contamination.

Coal Strip Mine Waters Evaluated as Fishery Habitat

A key project consists of investigating the sport fishing potential and fish management techniques for waters formed during coal strip mining. Memoranda of Understanding with Old Ben and Peabody Coal Companies provide access to principal study sites in Warrick and Pike Counties in Indiana. A third Memorandum of Understanding with Ohio Power Company, to be completed in 1978, will provide study areas for cooperative State/Federal projects in Ohio.

Strip mine investigations in 1977 were directed toward a study of sport fish populations in strip mine lakes stocked in the early 1970's. Initial efforts on this project were to evaluate the long-term results of yellow perch and smallmouth bass stockings in combination with other species. A report covering the 1977 phase of this project will be completed in 1978.

Investigations Continue on the National Petroleum Reserve, Alaska

During 1977, jurisdictional authority over the management of the Naval Petroleum Reserve No. 4 (PET–4) was transferred from the Department of the Navy to the Department of the Interior. This area, now known as the National Petroleum Reserve—Alaska (NPR–A), contains an estimated 10–33 billion barrels of oil and 90 billion cubic feet of natural gas. The Department of the Interior is charged with establishing a task force to study and determine the values of and best uses for lands contained on the Reserve, taking into consideration: (1) the natives who live or depend upon such lands; (2) the scenic, historical, recreational, fish and wildlife, and wilderness values; (3) mineral potential; and (4) other values of such lands. As a result of this action, fishery resources personnel devoted considerable effort during 1977 to fisheries work on the arctic coastal plains of Alaska.

Alaskan Indian graphic record

This effort culminated in a fishery management document that will be incorporated into the Comprehensive Land Use Plan for the National Petroleum Reserve.

Fisheries Assistance

Inland Fisheries and Reservoirs Program

Use of Hatchery Fish Evaluated

All fishery assistance offices continued to conduct evaluations on use of hatchery fish. These ranged from limited qualitative studies to more sophisticated efforts such as evaluation of the Black Hills trout program. These evaluations will be intensified during FY 1978. Specific plans have been developed for evaluating two strains of catchable rainbow trout in the Black Hills area, and four strains are to be evaluated in the field by hatchery personnel at the Bozeman Fish Cultural Development Center, Montana.

Trout Strains Undergo Evaluation in Rocky Mountains

A creel census is continuing to evaluate two strains of hatchery rainbow trout at the Blackfeet Reservation Duck Lake. Additional strain evaluations are in progress at the Blackfeet Magee Lake and two lakes of the Black Hills National Forest. Rainbow trout strain evaluations will be expanded during 1978 through utilization of one additional fish strain.

Preliminary investigations of a variety of cutthroat trout native to waters east of the Continental Divide (including the Wind River Indian Reservation) were also pursued. A discussion with staff of Colorado State University and Wyoming Game and Fish personnel indicates that the cutthroat in South Paint Rock Creek (Bighorn Mountains) is especially adaptable for stream habitat. Arrangements are presently being made to obtain eggs for establishment of a broodstock at Saratoga National Fish Hatchery. Future use of the fish will be to establish populations in stream habitats on the reservation.

Activities at the Blackfoot Indian Reservation, Duck Lake Montana. Gill nets (lower left) are used to sample fish populations. Net picking (upper right) is one of the chores associated with this method of fish collection. Rainbow trout being weighed and measured (lower right).

Cooperative Trout Management Program Evaluated

Fishery resources personnel were involved in an evaluation of the State/Federal cooperative trout management program in the Black Hills National Forest.

Noteworthy accomplishments included completion of the three year Black Hills trout management evaluation. In this study, hatchery-reared rainbow and brown trout were stocked over resident populations of brown trout. Data show a 50 to 80 percent creel return of rainbows but only a 30 to 50 percent return of the browns. Findings from the Black Hills trout management evaluation indicated certain streams had an ample stock of wild brown trout to support the fishery.

Fisheries Assistance

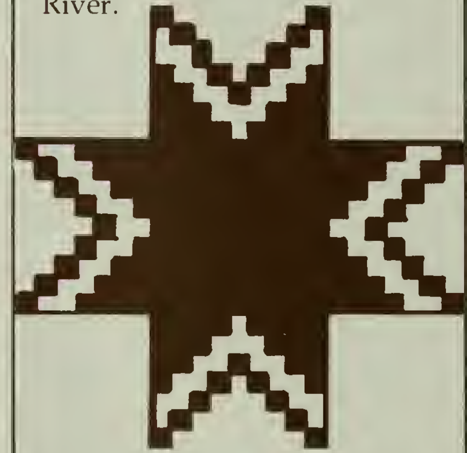
Inland Fisheries and Reservoirs Program

Central Utah Project Evaluation Continued

Particular emphasis has been placed on evaluating the effects of the proposed Bureau of Reclamation Central Utah Project on the fishery resources of Uintah and Ouray Indian Reservation. In 1977, a report entitled "Mitigation Potential of the Cold Water Fishery Habitat on the Uintah and Whiterocks River Under Central Utah Project Flows" was prepared in cooperation with Bureau of Reclamation fishery biologists.

Truckee River Water Quality Studies Continue

Fishery resource personnel have been involved in technical assistance on many projects on the Truckee River in Nevada. These activities have included: discussions with the Corps of Engineers on a proposed channelization project in the Reno area and its impact on the river downstream; participation as technical advisor to the Washoe Council of Governments 208 Areawide Quality Management Plan; participation in public workshops and testimony before the State Environmental Commission on proposed water quality standards for the Truckee River continued involvement in the proposed Reno/Sparks Point Water Pollution Control Plant expansion and environmental impact statement and participation as a technical advisor to the E.P.A.—City of Reno water quality study on the Truckee River.



Tribal Control of Fishing on Reservations Begun.

Because one major goal of Fishery Resources is to enable Indians to control tribal fishery resources, staff often assist tribes in formulating regulations. In 1977, the Fort Mojave Indian Reservation began selling hunting and fishing permits for the first time. Although the tribe has interest in developing its resources, the land status presents major problems. The reservation is extremely checkerboarded with private lands, and ownership of many of the lands along the Colorado River, which runs through the reservation, is disputed. The tribe controls some shoreline areas along the river, but these areas are often managed by the States. There are good fishing areas on the reservation; however, most are in areas that have been leased from the tribe.

The Chemehuevi Indian Reservation, along the west shoreline of Lake Havasu in California, has few natural resources. The tribe recently acquired some shoreline areas of Lake Havasu, and it may intend to sell fishing permits to shore anglers. However, the tribe has no jurisdiction control below the high water level of the lake.

In the spring of 1977, the Santa Clara Pueblo initiated a fishing permit system that will facilitate the maintenance of accurate records concerning fisherman use of Santa Clara Canyon. The Pueblo also purchased a new fish distribution tank for hauling hatchery fish. It will be put into operation in 1978.

The Joint Business Council of the Shoshone and Arapahoe Tribes issued fishing regulations and opened several tribal waters to non-Indian fishing in April 1977. This was the first time in several years that waters on the reservation have been open to fishing by non-Indian people.

Impacts of Coal Development Assessed on Crow Indian Reservation, Montana

Fishery resources staff have provided assistance on the writing of environmental impact statements covering potential coal development on the Crow Indian Reservation. The U.S. Department of the Interior has recently cancelled all coal mining leases on the reservation that were formerly held by energy development companies because the companies and the tribe were not able to formulate mining contracts within time limits specified by the Department. However, the tribe is continuing to negotiate with certain energy companies.

It appears that coal development will someday become a reality on the Crow Indian Reservation. The fishery resources staff, therefore, has begun working with new tribal leadership on plans for conducting baseline inventories of reservation streams that could be adversely impacted by strip mining.

Training Activities Continue

Fisheries assistance personnel also provide training in fish culture and management to native Americans and staffs of fish and game agencies. Training includes fish identification and capture methods and technical studies such as inducing fish species to spawn artificially. For example, in Montana, a group of young students from the Lame Deer School were trained at the Bighorn River, where they learned how to capture and identify several different fish species endemic to the river. In other places, Indians were trained at national fish hatcheries (NFH) in cool-water hatchery operations and given instructions in the basic techniques of scale reading. Indian students at Senta Gleska College on the Rosebud Reservation assisted biologists with surveying lakes and gained practical fishery management experience. In addition, two tribal fish samplers have been employed under the Comprehensive Employment and Training Act (CETA) program at the Lac du Flambeau Indian Reservation. During the winter months, the crew is conducting an ice-fishing creel census in tribal lakes. These employees will also be available to assist in survey studies during 1978.

In other training activities, a regional fishery workshop was conducted at Kalispell, Montana, during 1977. Three teams of investigators collected fish population and habitat information from the Flatland Reservation Jocko River System, Glacier National Park, McDonald Lake, and the Blackfeet Reservation Cut Bank Creek.

Fish Hatcheries

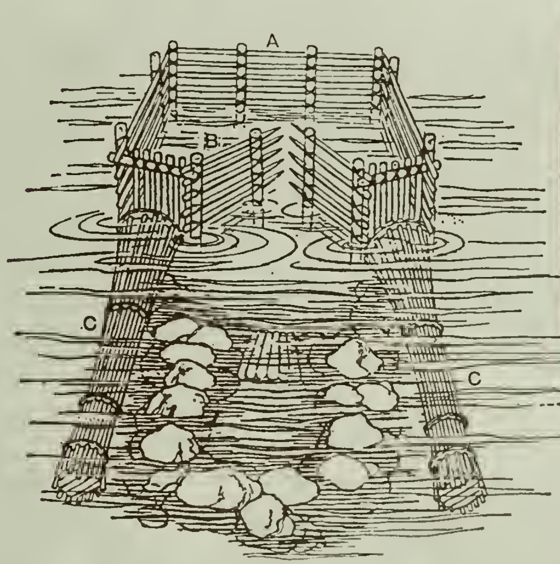
Coastal Anadromous Fisheries Program

Northwest Coast Halibut Club

Fish production is a major function of the Fishery Resources Program. Fisheries Assistance and Research both depend upon the fish produced at hatcheries for their work. The activities undertaken at fish hatcheries of the Coastal Anadromous Fish Program include:

- Collection of adult fish and eggs for hatching, rearing, and stocking programs into natural bodies of water.
- Spawning and producing eggs, fry, fingerlings, and adults for stocking and research purposes.
- Distributing fish and eggs collected and produced to Federally owned and managed waters, Great Lakes, Indian lands and waters, and to research facilities.
- Conducting feeding trials, testing intensive fish cultural methods and techniques for various fish species, and studies on growth rates and feed conversion ratios.
- Control and eradication of disease at infected hatcheries.
- Construction and maintenance of hatchery facilities including ponds, raceways, buildings, water supplies, aeration devices, and pumps.
- Developing operational plans for both new and improved hatchery facilities.

Fish and fish eggs are collected through various means, including weirs, fish traps, seines, trawls and gill nets. Sometimes low water conditions, especially in the western U.S., necessitate the transport of fish stocks to other, more suitable environments. This also requires careful handling and maintenance. Projects in each category are described below.



The plan of a Kwakiutl salmon trap. (A) is a fence which generally extends some distance beyond the low-water banks of the river. Attached to this fence is a box-like structure (B) built of frames tied to stakes and located in the middle of the river. On each side of the box are two short frames with openings that lead into long, narrow fish baskets (C).

Northwest Coast Halibut Club

Fish Hatcheries

Coastal Anadromous Fisheries Program

Salmon Eggs Procured for New State Hatchery in Alaska

Fishery resources personnel responded to a request in September by the biologist for the new Tamgass Creek incubation facility, Metlakatla, Alaska, to assist in capturing adult salmon to provide eggs needed to begin operations. The Ketchikan Fishery Resources Office furnished personnel and the motor vessel *Kodiak Bear II*. Twenty-one man-days were expended by FWS fishery resources and ecological services personnel and Annette Island Comprehensive Employment and Training Act (CETA) employees to acquire three million eggs, which were transported to the Tamgass Creek facility for fertilization and incubation. Ultimate capacity of the hatchery's rearing and incubating facilities will be 60 million eggs, and production is expected to reach this figure by the mid-1980's.

Connecticut River Salmon Return

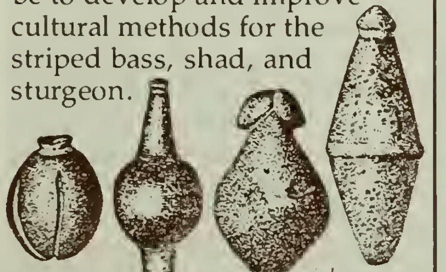
Seven Atlantic salmon adults returned to the Connecticut River during FY 1977. Four of these were captured alive and taken to the Federal Berkshire Trout Hatchery in western Massachusetts. A male and female survived through the summer until spawning season, and approximately 8,500 eggs were spawned and fertilized from this pair. These eggs represent the first mating of a pair of Atlantic salmon that have returned to the Connecticut River in over a century. The male was also used to fertilize about 21,500 eggs from hatchery-reared stock.

Edenton National Fish Hatchery Develops Striped Bass Broodstock

Since 1969, the Edenton National Fish Hatchery in North Carolina has been developing a domesticated striped bass broodstock to increase total egg production. A study is now being conducted to evaluate the potential of Edenton as an anadromous warm-water fish cultural development center. One of the principal objectives will be to provide

The Orangeburg, South Carolina National Fish Hatchery produces striped bass fingerlings for the Coastal Anadromous Fish Program.

developmental guidance for the fish cultural techniques necessary to maintain, sustain, and perpetuate natural and artificial productivity and biological, economic, and esthetic values of specific species. Early priorities of the center would be to develop and improve cultural methods for the striped bass, shad, and sturgeon.


sinkers

Abernathy Salmon Cultural Development Center Work Continues

Development projects carried on at the center in 1977 include:

- Nutrition studies and quality control of fish feeds.
- Effect of therapeutic drugs on biofilter organisms.
- Selective breeding and handling of green eggs from fall chinook salmon.
- Definition of optimum pond loading levels for fingerling salmon and factors causing white spot and coagulated yolk disease.
- Computerization of hatchery production records.

Distribution of Fish Produced at Hatcheries Continues

Fish that are either reared or spawned at hatcheries are distributed to Federal and State waters, to Indian lands, to fisheries assistance and fisheries research personnel, and sometimes to individual farm pond owners. Distribution includes transporting fry, fingerlings, and adults by various vehicles as well as stocking waters nearby with hatchery-produced fish. Fish are distributed by fishery assistance personnel, fish hatcheries staff, and by personnel from other interested agencies, such as the National Marine Fisheries Service (NMFS). For example, the striped bass has evolved as an important coastal anadromous fishery. Fourteen warm-water hatcheries were involved in the production of this species in FY 1977. A large percentage of the striped bass produced were involved in "payback" to those State agencies supplying the fry. A total of 3,235,457 striped bass were distributed. Atlantic salmon were also distributed.

Six national fish hatcheries produced Atlantic salmon for the restoration effort in New England rivers. These salmon were distributed to rivers in Maine (377,000 smolts), the Connecticut River System (112,000 smolts and 50,000 parr), and the Merrimack River System (27,000 smolts and 72,000 parr). The large number of parr stocked was due to removal of Berlin National Fish Hatchery from the smolt production program due to disease losses and slow growth. The total run of adult Atlantic salmon handled on the Penobscot System in Maine was 576 fish. The total Maine Atlantic salmon run was 956. The water conditions were such that the sport catch was the third highest in the history of the Penobscot River, with 177 being taken.

fishing lure

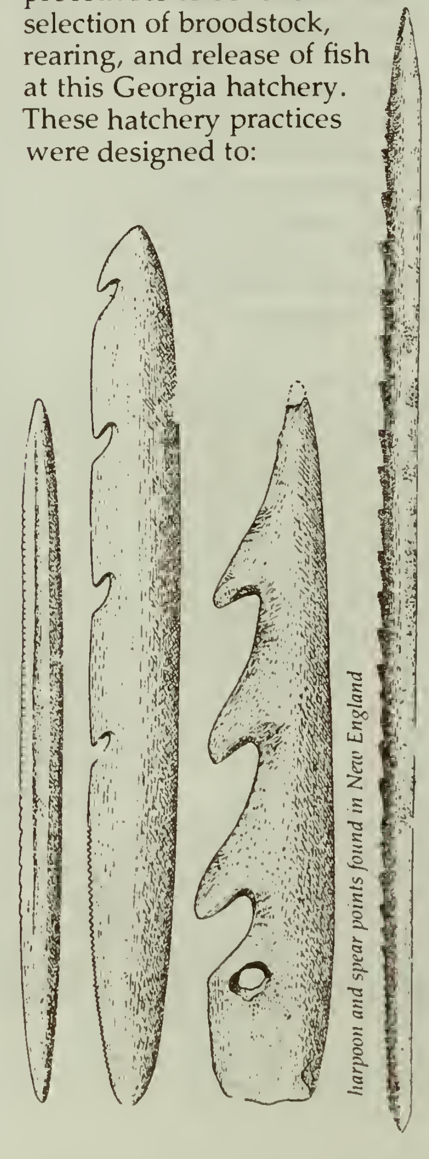
Fish Hatcheries

Coastal Anadromous Fisheries Program

Construction and Maintenance of Hatcheries Proceeds

National fish hatcheries are more than ponds or raceways in which fish are reared. The facilities at national fish hatcheries include buildings, ponds, tanks, raceways, water supply systems, roads, walkways, pumps, fences and utilities, and various laboratory and maintenance equipment, all of which must be maintained and repaired. Funds each year are earmarked for repair and maintenance to assure useful life expectancy of fish hatcheries that produce anadromous fish.

At present, two large smolt production stations are under construction, one at White River in Vermont, the other at Green Lake in Maine. White River is approximately 50 percent completed with the hatchery building and outside raceways ready for use. Work is still required to provide adequate water supplies from the river. Limited fish production is expected to begin in FY 1978. Green Lake is over 90 percent complete, and should reach production of 600,000 smolts in FY 1979.


harpoon and spear points found in New England

Warm Springs National Fish Hatchery Operational Plan Completed

The plan outlines the procedures to be followed for selection of broodstock, rearing, and release of fish at this Georgia hatchery. These hatchery practices were designed to:

- Maintain the natural physical variation exhibited in wild stocks within the hatchery stock by random selection of broodstock with regard to physical characteristics.
- Maintain similar run-timing characteristics of the present run by systematic selection of broodstock throughout the run in proportion to their abundance. Fish from two distinct segments of the run will be spawned separately so as to maintain any possible genetic factor that may determine run timing.
- Release all anadromous fish from the hatchery at the best time and size for survival, keeping residualism and competition of hatchery fish with resident fish in the stream at a minimum.

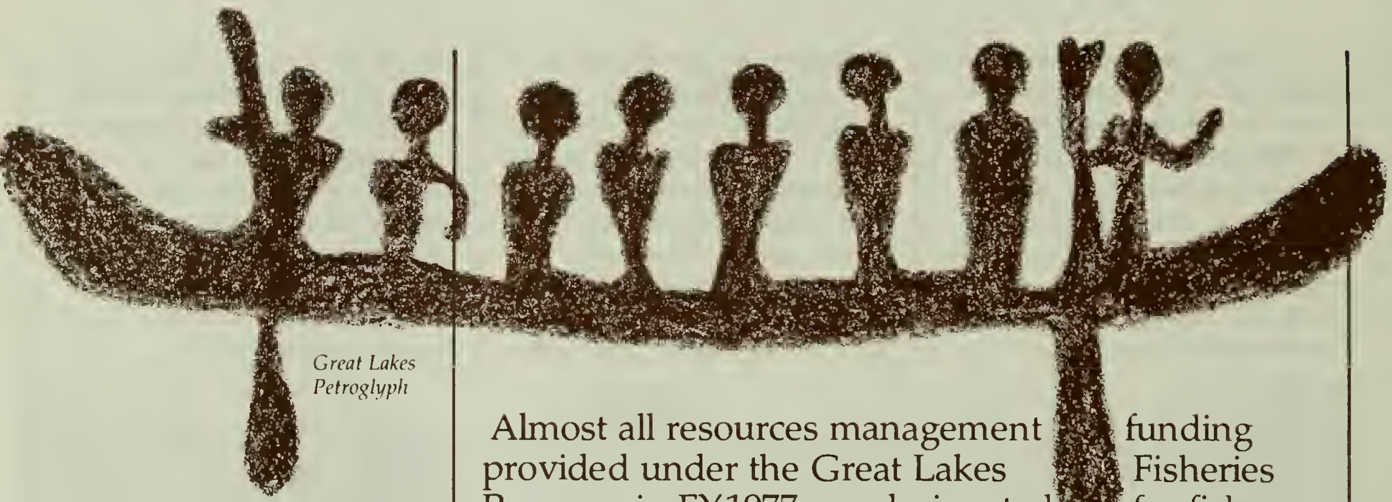
harpoon point

To do this, a program to evaluate the possible impacts of hatchery fish on resident trout in the Warm Springs River was developed. Wild fish were trapped as they migrated downstream and growth data were obtained from scale analysis for fish within a study area below the hatchery and for fish within a controlled area above the hatchery. Any differences in growth will be correlated with the degree of residualism within the lower area to determine if a true relationship does exist. Field work on this project began late in 1977 and will continue for at least the next four years.

Disinfection and Disease Eradication Important to Hatcheries

In any hatchery program, the more serious problems occur from disease and/or poor water quality. Disease organisms may be brought in with fish trapped from the wild or from other hatcheries and infect the rest of the broodstock; a pollutant in the water supply may kill all the eggs and fry. Either occurrence results in loss of production and the need for disinfection and restocking of the facilities. These activities are performed by the hatchery biologist.

Treating warm-water fish with formalin to control ectoparasites.



Great Lakes Petroglyph

Fish Hatcheries

Great Lakes Fisheries Program

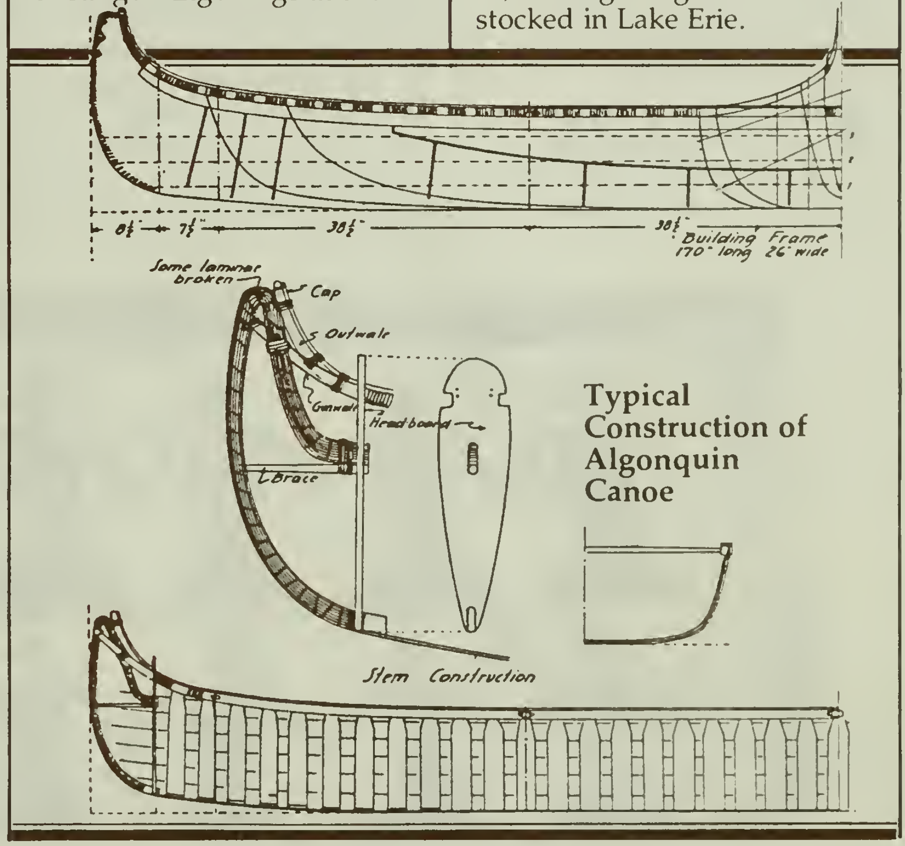
Almost all resources management funding provided under the Great Lakes Fisheries Program in FY1977 was designated for fish production, primarily lake trout and sauger. Three hatcheries were committed to producing lake trout for stocking into all of the Great Lakes, and three others produced sauger for Lake Erie. In most activities, the national fish hatcheries under the Great Lakes Fisheries Program are working closely with the Great Lakes Fishery Commission (GLFC) Disease investigations at hatcheries are primarily geared toward the diagnosis of native fish diseases and treatment. Work on diseases is conducted by hatchery biologists and is closely coordinated with the Great Lakes Fishery Commission Disease Control Committee. As in other programs, hatcheries are also being constructed and maintained. Some of these activities are described below.

Production of Fish for Great Lakes Continues

In FY 1977, three hatcheries—Jordan River, Pendills Creek, and Hiawatha Forest, Michigan—were committed solely to the production of lake trout for the Great Lakes. A total of 1,213,000 fish were stocked into Lake Superior, 2,381,000 into Lake Michigan, and 957,000 into Lake Huron. These fish were stocked according to a schedule coordinated through the Great Lakes Fishery Commission and the State agencies. Jordan River NFH also produced 575,000 lake trout in an accelerated-growth program for stocking in Lake Ontario in October 1976. These were produced under contract with the State of New York. The Service provided rearing space and labor, and New York provided fish food and paid all distribution costs.

A cooperative program for production of splake was reviewed during FY 1977, and agreement was reached with the States and the GLFC to terminate the program. Splake broodstock maintained for sperm collection at Genoa NFH was disposed of by stocking on the Red Lake Indian Reservation. The final lot of splake fingerlings produced at Pendills Creek NFH were stocked in Lake Huron in October 1977.

The Ohio Department of Natural Resources is attempting to restore the sauger population of eastern Lake Erie, and the Fish and Wildlife Service provides assistance in the production of sauger fingerlings at the Genoa, Hebron, and Senecaville National Fish Hatcheries. Genoa National Fish Hatchery personnel trapped and spawned sauger in the Mississippi River and provided the eggs to Hebron and Senecaville for rearing. Extremely low water conditions during the spawning season limited the egg take at Genoa. A total of 93,000 fingerlings were stocked in Lake Erie.



Typical Construction of Algonquin Canoe

Fish Hatcheries

Great Lakes Fisheries Program

Fish Disease Studies Proceed at Hatcheries

The Genoa Fish Hatchery Biologist Laboratory continued its activities in fish disease work in the Great Lakes area through routine duties of supplying diagnostic and technical assistance to Service, State and private installations. The lab continues to work with the Great Lakes Fish Disease Control Committee of the Great Lakes Fishery Commission for the implementation of basinwide disease control programs.

A Program to survey free-ranging salmonids in the Great Lakes for the presence of serious fish diseases was initiated. Research vessels from the Fish and Wildlife Service and State agencies conduct stock assessments to determine population characteristics at certain locations and to measure progress in the lake trout management program. This stock assessment program provides an opportunity to obtain fish disease samples from marked lake trout from several sites in each of the lakes each year and also provides an opportunity to collect pesticide and environmental contaminate samples for analysis.

New Hatchery Construction Planned

Funds were appropriated in FY 1977 for initial planning, design, and land acquisition for Iron River NFH in northern Wisconsin. An environmental assessment was written on the proposed project, and based on this assessment, a negative declaration was issued and approved by the regional director. Several public meetings were held in the Iron River area to explain the proposed hatchery. Design and land acquisition is proceeding, and initial construction activity should start in late summer of 1978.

beaded bag

Fish Hatcheries

Inland Fisheries and Reservoirs Program

The major objective of the Inland Fisheries and Reservoirs Program is to produce and rear inland fish species for stocking into Federal, State, and Indian waters in order to improve, restore, and maintain commercial and recreational fishing. Fish production includes collecting adult fish and eggs from natural waters to provide new hatchery stocks, evaluating strains of fish for fish cultural potential, and construction and maintenance of hatchery facilities. Hatcheries also study diets of cultured fish and investigate ways of spawning and rearing new fish strains. Disease is a very serious problem because it can spread quickly

conch shell found at Spiro Mound, Oklahoma throughout the hatchery ponds and tanks. Because of this, in 1977, many hatcheries had to be disinfected and sterilized before being restocked.

Personnel at fish hatcheries and development centers work closely with research and fisheries assistance. Hatchery fish are provided for both activities. Some of the fish produced at hatcheries in the inland fisheries program include largemouth bass, bluegill, redear sunfish, northern pike, walleye, striped bass, tiger muskie, sauger, channel catfish, rainbow trout, and brook and brown trout. The major Inland Fisheries and Reservoirs Program activities undertaken at fish hatcheries include:

- Collection of adult fish and eggs for hatching, rearing and stocking programs.
- Spawning and producing eggs, fry, fingerlings, and adult fish for stocking and research purposes.
- Distributing fish and eggs collected and produced to Federally-owned and managed waters, the Great Lakes, Indian waters, and research facilities.
- Conducting experiments on diet, intensive fish cultural methods, growth rates, and production of pathogen-free trout eggs.
- Construction and maintenance of hatchery facilities including ponds, raceways, buildings, water supplies, aeration devices, and pumps.
- Sterilization and disinfection of hatcheries infected with various fish diseases.
- Providing training in fish culture techniques and methods.

Fish Hatcheries

Inland Fisheries and Reservoirs Program

Many of the fish species used for research, stocking programs, and production at hatcheries must be collected from natural water bodies. Some hatcheries collect wild adult fish to serve as original broodstock and produce eggs from these captive fish; others collect eggs, then hatch and rear the young fish to stocking size. National fish hatcheries often have arrangements with State hatcheries to produce fry from eyed eggs or to spawn fish and provide eyed eggs to the States in return for broodstock and egg supplies. Some fish species are difficult to spawn in hatcheries; their eggs must be collected in the field to provide adequate egg supplies. Because of the drought conditions that persisted in 1977, many hatcheries in the Inland Fisheries and Reservoirs Program were not able to collect as many fish and fish eggs as needed for projected production. The following examples show how collection of eggs and fish is dependent upon environmental conditions such as water quality and stream flow.

Brown Trout

Transferring brown trout fry from incubators to rearing troughs is a routine hatchery activity at the Pisgah Forest National Fish Hatchery in North Carolina.

Fish Hatcheries

Inland Fisheries and Reservoirs Program

Brook Trout Eggs Collected and Introduced into Artificial Redds

In 1977, the tribal spawn-taking operation on Owhi Lake on the Colville Indian Reservation, Washington, produced an estimated 2.3 million green brook trout eggs. Winthrop National Fish Hatchery eyed all these eggs. Surplus eggs, nearly 1.6 million, were introduced into artificial redds on reservation waters by the tribe. The eyeing station at Owhi Lake was not able to operate this year due to depleted water flows.

Low Water Conditions Reduce Production of Fish

Genoa National Fish Hatchery, Wisconsin, was primarily involved with the production of largemouth bass, rainbow trout, northern pike, and walleye. They also take spawn from nearby sauger spawning runs and thus play an important part in supplying eggs and fry of other species to other hatcheries in the region. Extremely low water conditions in the spring of 1977 adversely affected spawning runs in traditional trapping areas with a resultant drop in production of these species.

Walleye, Pike, and Bass Collected and Stocked in Montana

Early in October 1976, personnel at Miles City National Fish Hatchery, Montana, collected fish from the Tongue River Reservoir. Walleye eggs were taken at Fort Peck Reservoir in an attempt to locate a nearby egg source. Nearly 750,000 eggs were taken; of these, about 75 percent hatched. The fry were used for stocking rearing ponds and stocking of Baker Lake. Northern pike fry were received from Valley City NFH. They had a low survival rate, possibly due to pH shock or overcrowding in shipment. Eyed lake trout eggs from the Story State Hatchery, Wyoming, were received and hatched. Smallmouth bass production was hindered by lack of space and high water temperatures occurring early in the season.

Lahontan Cutthroat Trout Artificially Spawned

At Summit Lake Indian Reservation, Nevada, 360 female Lahontan cutthroat trout were artificially spawned. Over 1 million eggs were taken. In addition, about 90,000 eggs were placed in an incubator established at a small spring located above the lake to supplement natural recruitment to Summit Lake. Approximately 70,000 fry were subsequently released into the lake.

Egg Mortality Related to Water Temperature and Drought

In 1977, one continuing study at Pyramid Lake, Truckee River, Nevada, involved egg hatching success in relation to fine sediment concentration on the spawning gravels. At the Verdi, Nevada, State Hatchery, 100 percent egg mortality occurred. This was probably due to low water flow and water temperatures of 60° F or above.

Approximately 50 percent hatch and emergence was realized at the station near Truckee, California. The mortality was associated with near-lethal water temperatures during the incubation period. The best results were obtained from the station near Tahoe City, California, with approximately 85 percent hatch and emergence.

First Natural Redds Produced in Omak Lake

On Colville Indian Reservation, Washington, the Omak Lake spawning operation produced 135,000 green Lahontan cutthroat trout eggs. About 70,000 fingerlings will be planted in the spring of 1978. During the spawning season, flows in No Name Creek were regulated for sufficient volume to allow adult cutthroat to produce 35 redds. These are the first recorded natural redds for Lahontan cutthroat trout in Omak Lake.

Walleye Eggs Incubated as Part of Cooperative Agreement

The New London National Fish Hatchery, Minnesota, is principally involved in the production of walleye, smallmouth bass, and several other warm-water species. New London National Fish Hatchery has a cooperative agreement with the Minnesota Department of Natural Resources (DNR) in which New London incubates walleye eggs for the DNR and, in return, retains sufficient fry to meet their production commitments. Total production for FY 1977 was approximately 2.9 million walleye fry and 866,000 fingerlings of various species. In addition, 40,000 chinook salmon smolts were also produced and stocked on the Grand Portage Indian Reservation. The fish were raised under very marginal conditions using well water with high iron content.

Fish Produced for Army Reservoirs

In 1977, Senecaville National Fish Hatchery, Ohio, produced smallmouth bass, striped bass, walleye, sauger, channel catfish, and flathead catfish. Much of the production at Senecaville is used for management programs on U.S. Army Corps of Engineers reservoirs in Ohio. Difficulty was encountered with striped bass production due to competition from shad introduced into ponds through the water supply.

copper ornament design

Algae Growth Reduces Smallmouth Bass Production

The Neosho National Fish Hatchery, Missouri, met its salmonid production assignment for FY 1977. However, smallmouth bass production was reduced due to excessive algae growth. Filamentous algae grew so fast it covered the entire pond within 12 days after the pond was filled. This growth was caused by an enriched water supply from the salmonid rearing facilities and fertile pond bottoms.

Fish Hatcheries

Inland Fisheries and Reservoirs Program

Pathogen-Free Trout Eggs Produced

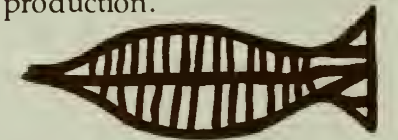
The Saratoga National Fish Hatchery, Wyoming, is a trout broodstock station established in 1915. The primary mission of the Saratoga station is production of high quality, specific-pathogen-free rainbow trout eggs for the National Broodstock Program. Eggs are also provided to Service research laboratories and to State and foreign resource agencies. Special attention and priority is given to golden trout, cutthroat trout, and other species of special interest. Eggs produced from station rainbow and golden trout amounted to 7,010,000 for FY 1977. In addition, Saratoga distributed 37,342 pounds, comprising 226,592 trout.

Established Spawning Grounds Eliminated by Low Water Levels

Pond culture at Valley City NFH, North Dakota, encountered major problems beginning with the spring northern pike and walleye spawning runs and continuing into the pond harvest of the 1- to 2-inch fingerlings. Dry conditions causing low water levels in Lake Ashtabula eliminated established spawning grounds and severely reduced the total females available for both northern pike and walleyes. An early spring thaw accompanied by wide fluctuations in water temperature also carried into the fry stocking period, further reducing the annual pond harvest. Distribution figures for FY 1977 reflect problems encountered due to extreme drought conditions which prevailed throughout much of 1976 and into 1977; however, total production and distribution figures still remained near the station's 10-year average.

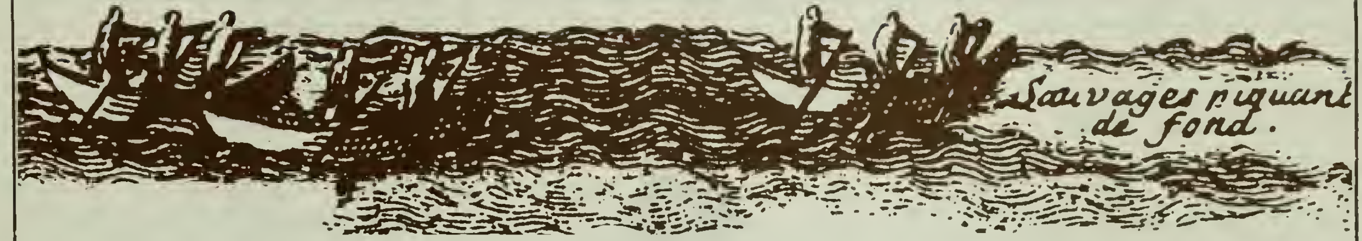
Old Broodstock Reduce Production—Replacement Planned

At Cedar Bluff National Fish Hatchery, Kansas, production was poor in 1977. Channel catfish broodstock were 7 to 9 years old and becoming nonproductive. Fingerling production fell short of assignments. Efforts to secure wild fish for replacements have failed. Largemouth bass production was also reduced. Many broodfish died over the winter and the remaining fish did not spawn well. There is now an orderly selection of fish for broodstock replacement, but it will be two to three years before full production can be established again for largemouth bass. Smallmouth bass production was only fair, although much better than largemouth bass production.



Rainbow Trout and Forage Fish Produced

At Neosho National Fish Hatchery, Missouri, salmonid production was 42,493 pounds, which is a considerable reduction when compared to previous years. Little or no growth occurred on 60,000 rainbow held in the warm-water ponds because of extremely low water temperatures caused by one of the coldest winters on record. Fertile pond bottoms, with an enriched water supply from the salmonid rearing facilities, create conditions that are ideal for accelerated algae growth. Despite this undesirable condition, the hatchery still produced 233,000 smallmouth bass.


Sauvages piquant de fond.

Excellent Production of Channel Catfish Breaks Record

Warm-water fish production at Gavins Point National Fish Hatchery, Nebraska, was characterized by the diversity of species handled and numbers produced. Significant accomplishments during FY 1977 included rearing of 210,000 lake trout fingerlings and successful hatching of 2,500,000 whitefish fry. The station also raised 220,000 yellow perch fingerlings. In addition, the old station record for production of channel catfish was broken with 965,600 fingerlings produced. Propagation of paddlefish also continued as a high priority species, and over 4,500 fingerlings were produced. Gavins Point has become the main source of northern pike for Servicewide programs.

Tribal Fish Hatcheries in Operation

The Bad River and Lac du Flambeau Tribal Hatcheries operated in the spring of 1977 and produced nearly 25 million walleye fry, plus smaller numbers of northern pike and muskellunge. Feasibility studies for the construction of new or replacement hatchery and rearing facilities for three northern Wisconsin tribal hatcheries are being circulated to the various funding agencies for consideration.

Various Diets Tested for Use at Hatcheries

Personnel at Senecaville NFH, Ohio, conducted experimental feeding trials on cool-water fish in support of an interagency effort to develop intensive rearing techniques for these fish. At Garrison Dam National Fish Hatchery, North Dakota, the salmon program got off to a slow start due to a combination of supersaturated water and poor quality feed. A diet change to the Oregon moist pellet resulted in an estimated recovery of 50,000 chinook salmon fry.

Fishery resources personnel of the Valley City/Baldhill Dam National Fish Hatchery, North Dakota, continued the formulated diet experiments in 1977. Diet trials for both muskie and tiger muskie and for the experimental lot of northern pike were limited, but continued to add to the information compiled at Valley City. Striped bass received as fry were reared in ponds to the two-inch size and were also tested on formulated diets under intensive cultural conditions with acceptable success.

Fish Hatcheries

Inland Fisheries and Reservoirs Program

Disease Traced to Transfer of Infected Rainbow Trout

The Genoa Hatchery Biologist Laboratory, Wisconsin, continued to provide assistance to all regional hatcheries and various States in detecting and treating fish disease during FY 1977. Enteric redmouth disease (ERM), caused by a bacterium, *Yersinia rucker,* was diagnosed by the Genoa Laboratory at two commercial hatcheries during the year. This disease, previously found only in the Intermountain West, was traced to the transfer of infected rainbow trout from separate commercial hatcheries in Missouri. The Genoa Laboratory provided assistance in several instances in the region in which furunculosis was responsible for the loss of salmonids during FY 1977. An acute outbreak among coho fingerlings at the Wolf Lake State Fish Hatchery, Michigan, in mid-June claimed some 200,000 of the one million fish in the hatchery. Teramycin therapy was successful in this case, but failed to hold an explosive furunculosis problem at the Lake Mills NFH in late July. About 30,000 of 48,000 four-inch fingerling brown trout were lost at Lake Mills before chloromycetin brought the disease under control.

Disinfection Halts Kidney Disease at Hatchery

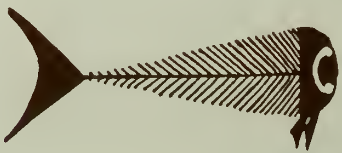
Disease was a problem at Ennis National Fish Hatchery, Montana, in 1977. The hatchery and water supply were disinfected in August to eliminate kidney disease. As a result, hatchery production of fish and eggs was reduced from previous years.

Fish cultural operations were terminated in July. All commitments were satisfied and two-year-old broodstock were placed in Canyon Ferry Reservoir. Total production amounted to 2,248,586 trout. The remainder of the fiscal year was spent in preparation of and disinfecting the hatchery and in maintenance of hatchery grounds, buildings, and fish production equipment.

Rainbow Trout Genetic Strains Evaluated

Twenty-five national fish hatcheries, in conjunction with the Fish Genetics Laboratory and Office of Fisheries Assistance, Washington, D.C., participated in the Rainbow Trout Growth Study Strain Evaluation Tests. The tests were designed to develop a file on approximately 16 strains of trout and will eventually contain information on genetic history capabilities, production performance at different hatcheries, and utility in management situation.

The role of each hatchery was to hatch eggs from one or more strains of rainbow trout supplied by the Fish Genetics Laboratory and rear the resulting fish to 10 inches in length. Production methods were standardized and designed to produce the maximum growth rate at the minimum temperature units per inch gain. The results will indicate which strains of fish



do best at a particular hatchery and also predict its performance at other hatcheries.

The test will continue either to termination of the lot or through stocking in FY 1978. Data will be compiled by the Division of Fishery Research.

Intensive Culture Trials Indicate Good Potential

Intensive culture trials at Cedar Bluff NFH, Kansas, indicate that there is a potential for production of northern pike, tiger muskie, and largemouth bass. Troughs were set up in the covered raceway building, and Loudon trough feeders were installed for automatic feeding of the W–7 diet. Northern pike fry were fed every 10 minutes for a 16-hour day. There were many problems: fry drifted onto the screens and smothered; the troughs overflowed; fish died from bacterial gill disease. Despite all the problems, the number surviving was much better than has been experienced in pond culture. Results with the tiger muskies were identical to the northern pike except that survival was slightly higher. The walleye feeding trial with the W–7 diet was almost a total failure.

Exotic Ohrid Trout Adapts to Hatchery Environment

At Erwin National Fish Hatchery, Tennessee, a fisheries management plan is being developed for the ohrid trout (*Salmo letnica Karaman*). This deep-lake Yugoslavian trout is being cultured at the hatchery, and the broodstock are beginning to adapt to the hatchery environment.

New Vaccine Used on Rainbow Trout

The Pisgah Forest National Fish Hatchery, North Carolina, vaccinated approximately 300,000 rainbow trout fingerlings for enteric redmouth disease with a vaccine developed by Wildlife Vaccines, Inc. These vaccinations will be evaluated to determine the impact on rainbow trout fingerling mortality.

Disinfection of Hatchery Removes Threat of IPN

One of the Service's largest trout stations, Hagerman National Fish Hatchery, Idaho, was completely disinfected during the fall of 1977. In the spring of 1977, infectious pancreatic necrosis (IPN) was diagnosed by one hatchery biologist and confirmed by the Fish Disease Laboratory, Fort Collins, Colorado. All fish were stocked in waters previously exposed to IPN before initial chlorine disinfection of the station and spring water supplies were undertaken. It appears that the disinfection program eliminated the disease source.

Fish Disease Seminar and Short Course Conducted

Personnel of the Genoa Hatchery Biologist Laboratory, Wisconsin, presented a fish disease seminar for Ohio DNR personnel at Ohio State University covering the current status of the major diseases of fish, with emphasis placed on problems relevant to Ohio and the Great Lakes Basin. Disease control methods were reviewed, including mass immunization of fish and the development of protective State regulations and disease control programs.

The 7th Annual Genoa Laboratory Short Course, "Introduction to Fish Health," was held at the University of Wisconsin—La Crosse. Twenty trainees attended the $4^1/_2$ day course.

Fish Hatcheries

Inland Fisheries and Reservoirs Program

Short Courses on Fish Culture Presented

During 1977, Valley City/Baldhill Dam National Fish Hatchery, North Dakota, personnel provided assistance to the Spearfish In-Service Training School in presenting two fish culture short courses held at the Spearfish station, and a third presented for State employees from Alaska was held in Juneau, Alaska. In addition, a 20-student Youth Conservation Corps Camp was established in 1977 at the Valley City Station.

Effects of Diet on Trout Fecundity Studied

The Bozeman Fish Cultural Center, Montana, is one of five installations of the Fish and Wildlife Service established for the advancement of fish husbandry. These units test findings of fisheries research on a pilot-plant basis prior to applying them to the operation of production hatcheries. During 1977, center activities included a study on the effect of diet composition on the fecundity of rainbow trout broodfish. This three-year ongoing project included the spawning of five-year-old fish. Data have been analyzed, and a final report is in preparation.

Information on Diets Collected

The Spearfish Diet Testing Development Center, South Dakota, collected information on contract diets, identifying problems and making changes in specifications during FY 1977. Research findings were incorporated into the program, and broodstock and cool water species diet development received continued emphasis. Two reports on diet were submitted for publication in scientific journals. These are "Evaluation of Full-Fat Soybean Meal in Rainbow Trout" and "Effects of Different Dietary Calorie-to-Protein Ratios on Fingerling Rainbow Trout." Quality control of contract diets was another important aspect of the diet center's mission. Ingredient analysis and plant inspections helped safeguard quality of the contract fish feed.

Nine Rainbow Trout Strains Evaluated

The Bozeman Fish Cultural Center, Montana, in cooperation with the Fish Genetics Laboratory in Beulah, Wyoming, is evaluating selected strains of rainbow trout for fish culture purposes. In FY 1977, nine selected strains of rainbow trout were evaluated. In addition, a study on the effects of temperature stress on rainbow trout was completed and a final report submitted.

Construction and Maintenance Work Continues

Construction and maintenance efforts in the Inland Fisheries Program continued during 1977 and included work done at the following hatcheries: Creston, Ennis, Jackson, Miles City, Saratoga, Garrison Dam, Cedar Bluff, Crawford, and Jones Hole. In addition, construction proceeded on the new Wolf Creek National Fish Hatchery in Kentucky.

Fishery Research

Coastal Anadromous Fisheries Program

Research on coastal anadromous fish species is oriented towards solving the problems encountered in the production and distribution of fish stocks. The major interests of research are the diagnosis and treatment of fish diseases, the development and testing of new fish foods and diet-related abnormalities, and the evaluation of fish species and strains for their potential for intensive fish culture. There is also increasing interest in the prevention and control of anadromous fish diseases. Much of the research assistance given to Indian tribes is concerned with identifying and treating fish diseases. Fish hatcheries have problems with disease in ponds and tanks; disease identification workshops are given for fisheries biologists and aides at hatcheries.

The demand for diagnosis and control of fish disease is being met through research facilities, hatcheries, and through cooperation with State fish and game agencies. For example, the technological breakthrough in chum salmon (*Oncorhynchus keta*) culture, employing gravel egg incubation boxes, has resulted in increased demands for fish disease diagnosis and control. This demand in the Northwest was met by a fisheries biologist with

bone harpoon point

extensive training and experience in fish pathology, using the facilities and expertise of the Fish and Wildlife Service Northwestern Fisheries Research Center, the Service's Abernathy Development Center, and the Washington Department of Fisheries. Similar facilities are being used for disease diagnosis and treatment elsewhere.

Alaskan canoe paddle design

Fishery Research

Coastal Anadromous Fisheries Program

symbol for net

Salmonids Accumulate Zinc in Tests

Steelhead (*Salmo gairdneri*) and cutthroat trout (*Salmo clarki*) and fall chinook salmon (*Oncorhynchus tshawytscha*) from representative hatcheries were tested, against controls, for accumulation of copper, cadmium, and zinc. No significant accumulation of copper and cadmium occurs during rearing of steelhead. Cutthroat trout and fall chinook salmon steadily accumulate cadmium, but total accumulation remains low. Cutthroat trout and fall chinook salmon accumulate zinc to near the recommended maximum allowable body concentration by the time of release, which may compromise their ability to cope with environmental stress.

Effects of Treatments on Coho Salmon

The effects of a number of medicinal treatments and anesthetics on coho salmon (*Oncorhynchus kisutch*) were studied. Adverse effects were noted in a simulated sea release. Mortalities were significantly higher when the release was immediately after treatment. Treatment effects were diminished but not eliminated 4 days after treatment.

Field Station Established in Alaska

A field station has been established in Anchorage, Alaska, and is working cooperatively with the Alaska Fish and Game Department. Studies are continuing on infectious hemorrhagic necrosis (IHN) in Alaskan Sockeye salmon. Methods for detection of the disease in carrier fish are being improved.

sinkers

Striped Bass Accept Formulated Feeds

A limiting factor for intensive hatchery production of striped bass (*Morone saxatilis*) is the absence of suitable artificial food for fry. Test diets composed of a variety of nutrients, and with various treatments to increase water stability, have not met with success in bringing the striped bass through the first few critical weeks after hatching. Feeding of fingerlings and adults is successful with food conversion rates of 2:1 from commercially available feed. Another advance has been the discovery that adult stripers from the wild can be trained to accept artificial rations by gradually replacing the natural live forage diet with chopped frozen fish and then with dry pellets.

Progress in Alternate Sources of Protein

The high cost and variability of the fish meal supply for inclusion in the diets of hatchery-reared fish continues to be the major factor limiting the expansion of fish production for sport fishing and direct human consumption. The search for alternate sources of protein has been directed mainly to soybean meal, not because it is the only product which could be used but from the standpoint of present and potential supplies, market availability, chemical composition, and cost, it appears most attractive. The rate of fish growth on these high soybean diets is slightly lower than on conventional diets.

Colorado River water devil

Salmonid Disease Spreads

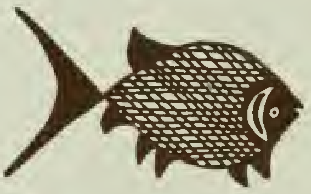
Enteric redmouth disease (ERM), a serious bacterial disease of salmon and trout, has spread to all trout growing areas of the U.S. and part of Canada and has recently been isolated in Australia. A comparison of areas has shown that, although the bacteria are similar morphologically and biochemically, there are three different seriological types. Fortunately, most of the outbreaks can be controlled by the serotype which is used in commercially available vaccines.

Identification of Fish Stocks Continues

The Columbia River Genetic Identification Study, a cooperative effort between the U.S. Fish and Wildlife Service and National Marine Fisheries Service, continued during 1977. The goal of this study is to identify anadromous fish stocks through the use of genetic markers and to estimate the contribution of each population to a mixed fishery. In 1977, fisheries resources staff collected 4,748 individual fish samples, which represented 49 different populations. A computer program to estimate the contribution of each population to the mixed fishery, based upon genetic variation data, was written and tested.

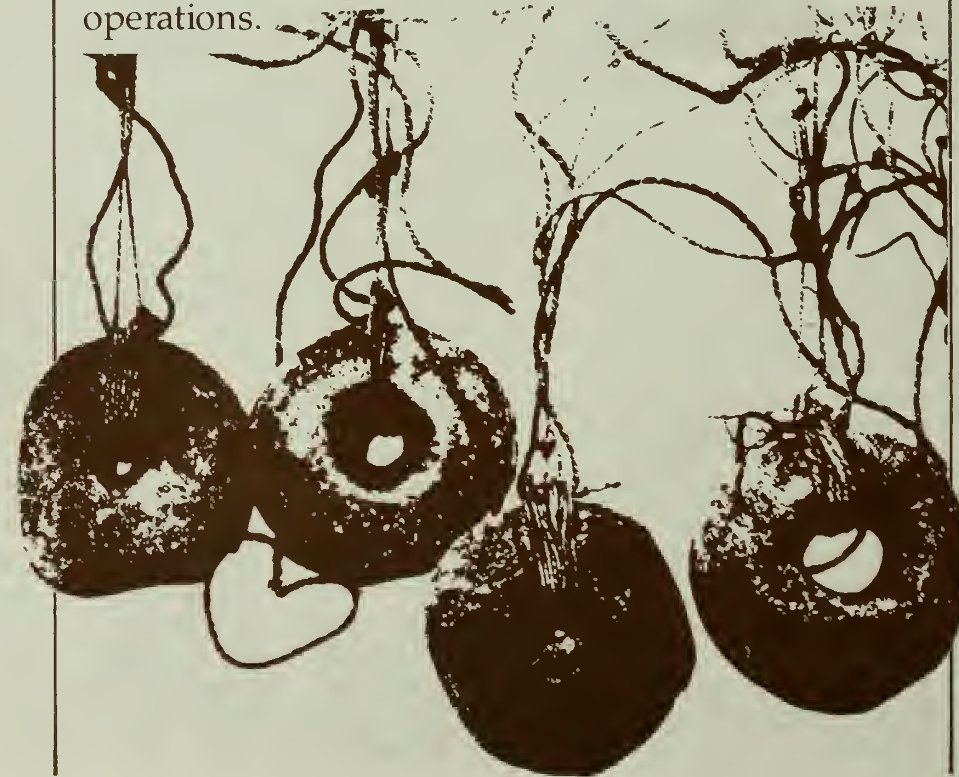
Tracking Shows Dams Hinder Migration of Atlantic Salmon

The 1977 sport catch of sea-run Atlantic salmon in the Penobscot River was the largest in 40 years. A small but encouraging number of returning adults in the Connecticut River should produce a second generation of salmon. Adults returning from the sea continue to face serious obstacles to upriver migration and reproduction. In a Service-sponsored study at the University of Maine, radio transmitters were inserted into the stomachs of 80 adult salmon that returned to the Penobscot River. For several months thereafter, the radio-tagged salmon were tracked in the river from aircraft and boats. The tracking data disclose that dams and inadequate fishways hinder upstream migration.



A 3-year ecological study of the Mattawamkeag River, a major tributary of the Penobscot, indicated that high water temperatures may be dangerous to parr and adult salmon in warm, dry summers. The introduced chain pickerel and smallmouth bass have become abundant in the Mattawamkeag and add to the predation and competition stresses faced by young salmon.

Fisheries research in the Great Lakes Fisheries Program is oriented toward improving the commercial and recreational fisheries of the lakes. The primary functions of research include the testing of chemicals for use as lampricides in tributary streams and studies on the sea lamprey life cycle in order to find a biological means of lamprey control. Of high priority are assessment of fish stocks and development of management strategies. Other research studies deal with the nutritional requirements of hatchery-reared fish and with water problems in fish hatchery operations.



Fishery Research

Great Lakes Fisheries Program

Sea Lamprey Control by Sterilization

A promising sea lamprey control method which uses the release of artificially sterilized sexually mature lampreys into streams containing spawning lampreys is being developed. In principle, these sterile individuals will compete with fertile animals for mates and thereby reduce the reproductive success of the spawning population. Early results suggest that sterilization of the male may be most effective.

Testing of Chemicals for Lamprey Control

The chemicals Bayer 73 and TFM are used in combination to control sea lamprey larval populations in large tributaries of the Great Lakes. Both chemicals are under investigation to provide the necessary data for registration and continued use. Glass shrimp were exposed to Bayer 73, and toxicity was found to be related to water hardness and pH, and results suggest the shrimp are not adversely affected by the levels of Bayer 73 normally used. Excretion of Bayer 73 was found to be rapid in rainbow trout.

The physiological basis for the selective action of TFM against lampreys appears to be due to the inability of the sea lamprey to conjugate and detoxify TFM. Studies of conjugates in several other species of primitive fish suggest fishes which are low on the phylogenetic scale are likely to be more susceptible to TFM.

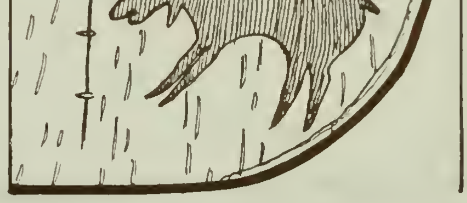
Lake Trout Populations Restored in Lake Superior

Partial control of sea lampreys, protective fishery regulations, and intense stocking have resulted in generally encouraging signs of rehabilitation of lake trout (*Salvelinus namaycush*) populations. Observations during 1977 indicated further improvement in all lake trout populations except those near Grand Marais, Minnesota, and in Whitefish Bay, Michigan.

Distribution of Larval Fish in Lake Huron Studied

Collections made in 1973–75 have been analyzed to reveal the species composition, distribution, and abundance, and to identify and delineate major spawning and nursery areas of fish in Lake Huron. Larval fish were most abundant in cover and bays, moderately abundant off sections of irregular shoreline, and least abundant off featureless shorelines. Important nursery areas are located in bays that have (1) large areas of shallow water, (2) rivers or streams flowing into them, and (3) infrequent or no upwellings. Seasonal changes also affected the species distribution in the water.

Studies were continued in an effort to develop a technical basis for forecasting future allowable catches of chubs (*Coregonus* spp.) in Lake Michigan. An analysis of data collected since 1968 indicates significant declining trends in chub populations in all geographic regions of Lake Michigan.



Fishery Research

Great Lakes Fisheries Program

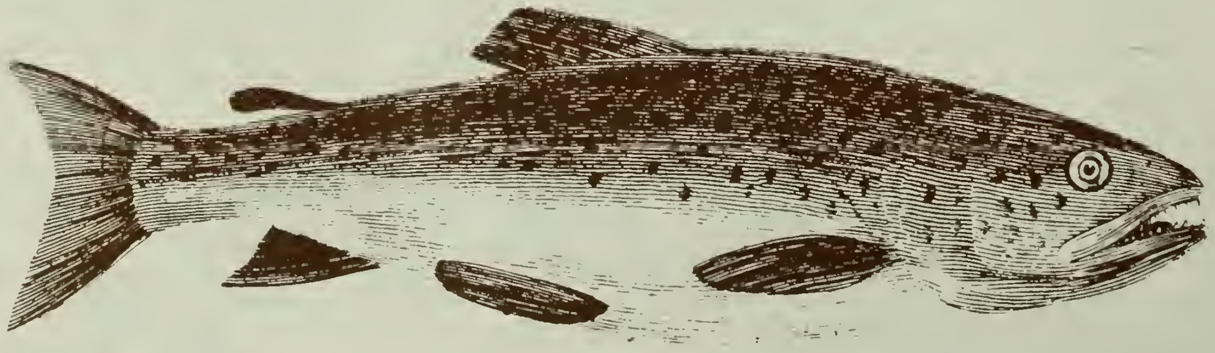
Yellow Perch

Natural Production of Lake Trout Observed in Lake Michigan

Long-term efforts at lamprey control and extensive stocking have produced a standing lake trout population estimated to contain several million individuals. First signs of natural reproduction in Lake Michigan were observed in 1977 in the Traverse City, Michigan, area.

River Management Studies Underway

A study of the distribution and abundance of the macrobenthos in the St. Clair-Detroit River System is underway in Michigan to evaluate the effect of proposed ice management strategies which may create ice jams and dams in navigational channels. The result may be a disturbance of benthic populations thought to add to the excellent recreational fishery of that area. Previous studies have shown that while the macrophyte population was quite stable from the late 1800's to the mid-1950's, substantial changes have since occurred. Related studies of water use on larval fish populations in the St. Clair-Detroit River System have shown that smelt (*Osmerus mordax*), alewives (*Alosa pseudoharengus*), and yellow perch (*Perca flavescens*) predominate during the spring and summer months, supporting the idea that this river system is a major spawning and nursery ground for important commercial species. The vulnerability of these larval populations to entrainment at water intakes and to exposure to waste disposal operations is being assessed.



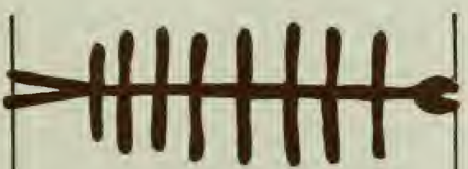
Lake Trout

Fishery Research

Inland Fisheries and Reservoirs Program

Research on inland fish species is oriented toward solving the problems in the production, distribution, survival, and harvest of fish stocks. The major research efforts of the Inland Fisheries and Reservoirs Program are the formulation and testing of new diets and feeds for intensive fish culture, the diagnosis and treatment of fish diseases, strain evaluations of cultured fish species, investigations into various aspects of fish husbandry, and training and field studies on inland fisheries. A sizeable effort is made to understand the dynamics of large reservoirs and fish populations therein and the causes of fluctuations of these populations. These activities are undertaken at various fish culture development centers and other research facilities across the country.

A primary responsibility of inland fisheries research is to perfect techniques for the diagnosis and treatment of fish diseases. Research focuses on the identification of diseases, testing of disease treatments, and the transfer of information on disease and treatment to fish hatcheries and fisheries personnel.



Whirling Disease Detection and Identification Methods Developed

New immunological methods have been developed for the detection and identification of the protozoan parasite (*Myxosoma cerebralis*) which causes whirling disease in salmon and trout. Knowledge of the parasite's life cycle is fragmentary, and the new methods provide another approach to solving the riddle of the life cycle. Rainbow trout (*Salmo gairdneri*) have been found to produce antibodies to *Myxosoma cerebralis* during the course of the infection. A test has been developed which can detect small quantities of fish antibody on the surface of spores after the spores have been incubated with serum from the blood of an infected animal. Using the test, antibodies against *Myxosoma cerebralis* spores have been found consistently in trout known to have whirling disease, while the antibodies are consistently absent in disease-free trout.

Vaccination by Osmosis Studies Continue

Hyperosmotic infiltration was introduced in 1975 as a means of delivering vaccines or other substances into large numbers of fish. Studies on the relation of the osmotic pressure, immersion time, pH levels, temperature, stress, vacuum, and fish size employed for effectiveness of delivery have now been completed. Higher osmotic pressure, pH, and temperature all contributed to greater uptake by the fish. Stress reduced the uptake; vacuum and fish size had no effect.

Selective Toxicant for Carp Control Tested

In 1977, the search for selective toxicants for removal of nuisance organisms included preliminary tests on the chemical GD–174. This compound shows a potential for selectively acting against the common carp. The effectiveness of this chemical in field use appears to be influenced by the water's acidity, the presence of water plants, and soil composition.

Polyculture in Ponds Compared with Monoculture Ponds

Polyculture ponds (channel catfish, (*Ictalurus punctatus*); big-mouth, black buffalo fish hybrids, (*Ictiobus cyprinellus* x *Ictiobus niger*); and fathead minnows (*Pimephales promelas*) had greater increases in total fish production, mean gain of catfish in grams per day, and mean weight of catfish than a monoculture pond (channel catfish). Settleable solids were significantly reduced in polyculture ponds as compared to monoculture ponds with channel catfish. No significant differences occurred in the measurement of suspended solids or turbidity between the two culture systems.

Fishery Research

Inland Fisheries and Reservoirs Program

Progress in Water Reuse Research Continues

Biological filters that use easily established bacteria and other simple organisms to remove toxic waste products of fish from aquaculture systems are the most practical and economical means of permitting reuse and conservation of fish culture water. Systems employing nearly 100 percent water reuse in fish culture systems require the application of advanced wastewater treatments of a physiochemical nature. The most effective systems include condensation and separation of an ozone-generated froth to remove surface-active complex organic wastes and associated mineral ions that are not biodegraded, followed by activated granular carbon absorption to concentrate and remove residual non-surface-active organic wastes. These experiments have established that the ozone-froth process is effective in maintaining healthy production loads of trout and salmon from fry to adults at full-growth potential and has the capability of maintaining normal reproduction in an essentially closed-cycle aquaculture system. This information is being used to design a practical fish culture system slated for construction in FY 1978.

Resin Removal in Hatchery Operations Studied

Removal of fishery chemicals from water is feasible during some culture and management practices, and removal could eliminate registration requirements concerning residues, tolerances, detoxification, hazards to the environment, etc. Several resins have been evaluated for their effectiveness in removing fishery chemicals and various oxidation states of nitrogen from water. Activated carbon is very effective for removing certain chemicals, and a prototype filter for hatchery use has been evaluated.

Studies Show Traits Lost with Inbreeding

A significant loss in a number of traits has been detected in the progeny of inbred (brother-sister) matings of rainbow trout. After one generation of inbreeding, the frequency of crippled fry increased 37.6 percent, while feed conversion efficiency, fry survival, and growth rate decreased significantly. After two generations of inbreeding, the frequency of crippled fry increased by 191 percent, while further decreases were noted in the other traits. Research indicates that careful consideration must be given in selection of broodstock so as to minimize the occurrence of inbreeding in hatchery stocks.

Selective Breeding Improves Growth

Certain wild strains of rainbow trout are known to grow much more rapidly than others. More rapid growth has been obtained in experimental work by careful selection of fish for broodstock purposes. The growth rate after three generations has been increased by 30 percent over control trout by careful selection of breeding stock. The selected fish were 70 percent heavier than normal counterparts after one year and 48 percent heavier after two years.

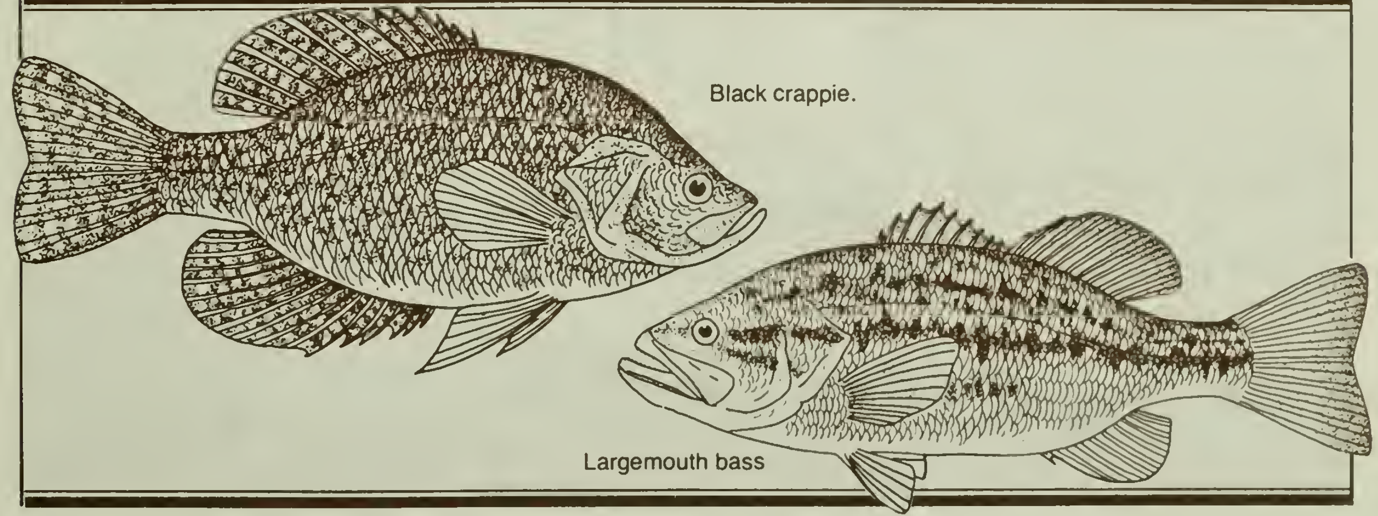
Sensitivity and Retention of Chemicals Studied

Two species of fresh water clams were tested for sensitivity to the fish toxicant antimycin at several concentrations. Both species were found to survive treatment levels recommended for field application. Latent mortalities were observed in some of the higher treatment groups; however, both species survived the maximum permissible use pattern concentration.

Formalin is a widely used chemical for treatment of external parasites of fish, but little is known about its retention in fish tissues. Largemouth bass (*Micropterus salmoides*), channel catfish, coho salmon, and rainbow trout exposed to 300 and 400mg/l for up to 4 hours were found to be free of detectable formalin in samples taken up to 24 hours after treatment. Channel catfish and largemouth bass held in 34 mg/l starting concentration for 24 and 72 hours were not found to have detectable levels of tissue formalin.

Reservoir Research Continues

Measurement of abundance of young largemouth bass in Beaver Reservoir, Arkansas, was accomplished through the use of effective fecundity estimates, average ages per nest determined by SCUBA, mark and recapture population estimates of bass fry using electro-fishing for collecting, and biological strains for mark and recapture procedures. Preliminary results indicate that only 1 in 6,000 eggs in the ovary survived to become one year-old fish, and 1 of 13 fry survived to age one. Underwater observations of largemouth bass reproduction during low lake elevations and a condition of no cover revealed that reproduction was about average. Survival was much poorer than when cover existed.



Fishery Research

Inland Fisheries and Reservoirs Program

Power Plant Reservoir Impacts Studied

Studies at the Duke Company's electrical generating complex at Keowee and Jocasse Reservoirs in South Carolina showed that the withdrawal of water beneath a skimmer wall (concrete dam with opening 19–27 m deep) minimizes the effects of using Keowee Reservoir water for nuclear plant condensor cooling on zooplankton and larval fish. Low catches of larval fish near the heated effluent in Keowee Reservoir were attributed to possible avoidance of the area by adult spawners due to evaluated temperatures or a flushing-downstream effect on the young fish from the water being discharged by the nuclear plant. The heated effluent from the Oconee Nuclear Station had no effect on the number of eggs produced by adult black crappie or on the food eaten by young black crappie.

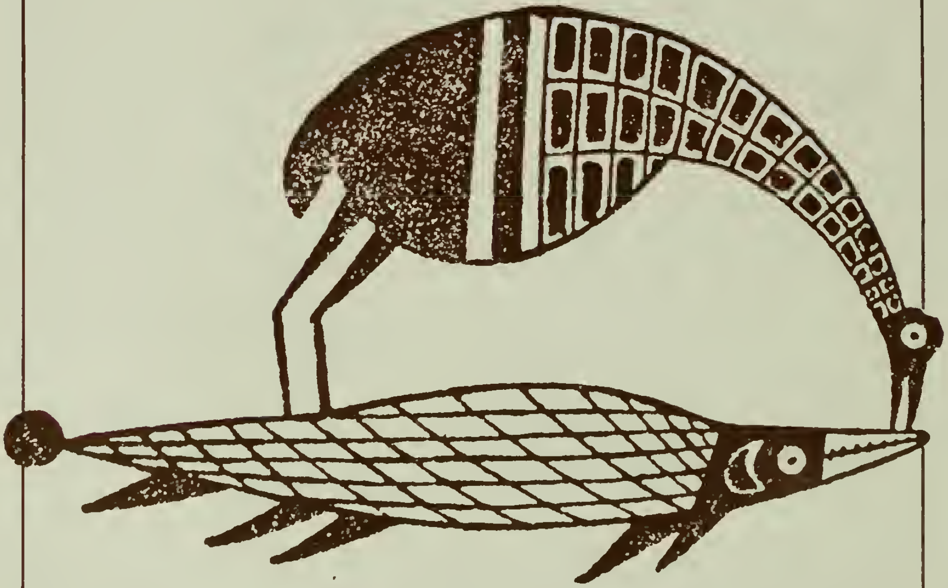
Seasonal Variation in Fish Studied

A study of seasonal variation in standing crop of fish was conducted in three reservoirs in Arkansas during the period May-September 1977. Standing crop of fish increased approximately 80% over the five month period.

Fish Health News Distribution Increases

Fish Health News (FHN) circulation has increased and is now received by 450 research laboratories, diagnosticians, libraries, and interested administrators in both the public and private sectors of the United States and Canada.

Larval fish sampling in DeGray Lake, Arkansas.



Related Program Areas

Fishery Resources activities are concerned with restoring, maintaining, and improving the quality, use, and abundance of recreational and commercial fish species. These activities are interrelated with other Fish and Wildlife Service programs, with Department of the Interior programs, and with other Federal and State programs involving fish and wildlife and their habitats. Many of the activities conducted as a part of Fishery Resources also contribute to other Service programs, such as Habitat Preservation and Endangered Species. The activities undertaken in these and other cooperative programs are important steps in the fulfillment of Fish and Wildlife Service goals. Some of these activities are described here.

Endangered Species

During FY 1977, many projects of Fishery Resources were involved with the protection and restoration of endangered fish species. Fishery resources personnel in Tennessee were involved in the management and recovery efforts on the endangered Okaloosa darter and the endangered snail darter. In Yellowstone National Park, efforts to restore Montana grayling into Canyon Creek continued. Eyed eggs from several sources were collected, incubated, and planted in the stream using vibert-type boxes. Youth Conservation Corps (YCC) crews assisted in maintenance and repair of the artificial barrier on the stream. A rare variant of the Yellowstone cutthroat group known to inhabit only one small stream in the park was the object of an active transplant program. In cooperation with the National Park Service and the Wyoming Game and Fish Department, fishery resources staff collected and flew approximately 500 adult and subadult Sedge Creek cutthroats to a previously barren stream in the Teton Wilderness Area (South Fork—Upper Yellowstone drainage). Similarly, a rare form of the Snake River cutthroat group—the Heart Lake cutthroat—which has been identified as being vulnerable to extinction, was transplanted to Pocket Lake in Yellowstone Park. The transplant of 1,000 wild cutthroats by helicopter followed rehabilitation of the lake to remove a stunted brook trout population. Field surveys, searching for native fish populations, continued as did the inventory to find suitable waters to use as enclaves for vulnerable or threatened species. Work in 1977 primarily concentrated on the Firehole River drainage.

In 1977, the Service, in cooperation with the Bureau of Indian Affairs, White Mountain Apache Tribe, Arizona State University, and the U.S. Forest Service, also conducted a unique restoration project for the threatened Arizona trout (*Salmon apache*) of Ord Creek on the Fort Apache Indian Reservation. The Arizona trout, also known as the Apache trout, has survived in the more isolated reaches of high mountain streams on the Fort Apache Indian Reservation.

The Arizona trout restoration project conducted on Ord Creek of the Fort Apache Reservation included the construction of a fish barrier to prevent the encroachment of non-native fish into the 2½ miles of Ord Creek headwaters and its tributaries set aside for the Arizona trout. The impact of this project on the survival and reproduction of Arizona trout will be monitored by the Service.

The Creston National Fish Hatchery, Montana, is continuing work with the once endangered westslope cutthroat trout. In 1977, broodstock produced enough eggs so that surplus fish were distributed into suitable Montana waters. The Montana State Fish and Game Department tagged and released cutthroat trout into Mill Creek to study migration.

Related Program Areas

Soil Conservation Service project at the Blackfeet Indian Reservation Cut Bank Creek is designed to remove bank stabilizing trees and vegetation from stream banks. Debris is being removed from a one-mile reach of stream.

Environmental Protection

Significant efforts were made by fishery resources staff during 1977 to preserve the aquatic environment. Working closely with the Soil Conservation Service, Bureau of Reclamation, and Bureau of Indian Affairs during stream channelization operations on the Blackfeet Indian Reservation, staff provided assistance to ensure compliance with the Federal Water Pollution Control Act (FWPCA). Subsequently, the U.S. Corps of Engineers has required that eight Section 404 FWPCA permits be obtained after-the-fact for Blackfeet Reservation Projects of 1977.

Mammals and Nonmigratory Birds

Fishery resources biologists at Kenai, Alaska, assisted in conducting predator-prey studies. Objectives of the studies are to determine pack movements and their effect on declining moose populations on the Kenai National Moose Range. When refuge pilots were not available Kenai fishery resources pilots assisted by providing aircraft support to electronically track radio-collared wolves.

Related Program Areas

Interpretation and Recreation

Many of the fishery resources facilities are open to the public and receive many visitors during the year. At some hatcheries and development centers, there are aquaria, and pamphlets are available describing the station to the public. For example, at Garrison Dam National Fish Hatchery, North Dakota, an estimated 31,000 visitors toured the hatchery this year. A self-guided tour brochure describing equipment and activities throughout the hatchery was printed and made available to those visitors. In addition, fishery resources staff provide natural resources information to the communities in which they work. Fishery resources staff in Kenai, Alaska, presented six field demonstrations and illustrated talks to students from Kenai Peninsula Borough Schools and Kuskokwim Community College. In addition, the Kenai Fisheries Resources Office was responsible for obtaining environmental education packets for the Borough School District's 23 schools.

Fishery resources staff also stock ponds that will be used for educational purposes. In Oregon, the Washington County Intermediate Educational District provides an outdoor educational program for sixth grade students. Environmental awareness is taught through a study of pond life and associated ecosystems. The trout planted in small ponds by fishery resources personnel provide recreation and education for children attending these camps. In addition to the educational aspects of this program, 500 man-days of fishing were provided by the 1,500 rainbow trout planted.

Training

Fishery resources staff provided training to native Americans, State technicians, and other fisheries management personnel in a variety of ways. In addition to formal classroom training, field training was given in all aspects of fish culture and management. In FY 1977, regional workshops were held with all regional fishery assistance personnel in attendance. Several positive outputs resulted from these workshops, including better communication between field, area, regional, and Washington Office personnel; better understanding of the direction Indian assistance is taking; increased awareness of how fisheries assistance activities meet Fish and Wildlife Service Fishery Resource goals; and increased knowledge of new fishery and resource management techniques and findings.

In cooperation with Flathead Valley Community College, Kalispell, Montana, Fish and Wildlife Service biologists conducted a 48-hour fishery science course designed for Indian tribal wardens and others. Fish and Wildlife Service presentations were provided in the fields of ichthyology, entomology, fish culture, fish nutrition, fish disease, fishery management, water quality, and environmental preservation. Tribal representatives from three Montana Indian reservations participated in the training process.

Various other strategies were employed in 1977 to help Indian tribes meet their fish health and diagnostic needs. Fisheries assistance in Vancouver sponsored a workshop for tribal biologists, including sport and commercial groups and educators, to exchange information on status of techniques for rearing salmon in Washington.

Cooperative Projects

Many Fishery Resources activities are done in cooperation with other agencies and programs, thus ensuring that assistance and production efforts are well coordinated. For example, a facet of the native stock enhancement program involves participation in the Northern California Demonstration Project, a three-year program funded by the National Aeronautics and Space Administration to employ remote sensing technology in solving natural resource problems of northern California. One of the studies involved in the project includes an evaluation of logging on the Hoopa Valley Indian Reservation and an aerial inventory of streams and streamside habitat located on the reservation and throughout the Klamath River drainage. Information obtained will be used to evaluate the logging program on the reservation and to develop future logging guidelines to protect stream ecosystems.

The Kenai, Alaska, fishery biologists assisted the Service's Western Alaska Ecological Services staff (WAES) by providing expertise in review of projects on the Kenai Peninsula. Fishery resources staff reviewed the Kenai Small Boat Harbor and Deep Draft Navigation Improvement Feasibility Report prepared by the Army Corps of Engineers. Fishery resources comments on the various alternatives were prepared for inclusion in WAES recommendations.

Related Program Areas

Law Enforcement

Over the years, a few commercial fishermen have illegally harvested large quantities of lake trout from Lake Michigan. Most of these fish were marketed in major cities in States other than where they were taken. This constituted a violation of the Black Bass Act. During a 6-month period in 1976 and 1977, 300,000 illegally taken trout were known to have been marketed. Because large-size Lake Michigan trout are characterized by high PCB content, it is possible to identify these fish in the marketplace. In one case, special agents using PCB content as an identifier established the presence of large-size Lake Michigan trout in major markets during a time when taking lake trout from Lake Michigan was prohibited.

International Activities

Fishery Resources personnel are often the Service's representatives on international and regional committees. The Great Lakes Fishery Commission is one such committee, but the Service is also a non-voting member of the following councils: the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council, the South Atlantic Fishery Management Council, the Caribbean Fishery Management Council, the Gulf of Mexico Fishery Management Council, the Pacific Fishery Management Council, the North Pacific Fishery Management Council, and the Western Pacific Fishery Management Council. The Fishery Resources contribution to these groups is to act as the representative of the U.S. in the protection and preservation of both recreational and commercial fisheries around the coastline of the United States and into territorial waters.

Dingell-Johnson Program

The Dingell-Johnson program has had an impact on sport fishing in different ways in each State. It helps fishery management by providing funds for many projects which could not otherwise have been undertaken. It also improves the capabilities of State fish and game departments by providing funds to hire technically trained personnel and to purchase needed equipment and facilities.

Some States have concentrated on research, others have emphasized building public fishing lakes and ponds, or have acquired access to water areas. Many States have devoted D-J money to improving the environment for fish and assisting fishermen. The availability of D-J funds has made it possible for all States to improve their fish management programs, each in its own way.

Engineering and Construction

National Fishery Research and Development Center, Wellsboro, Pennsylvania

Construction was started in 1977 on this new modern cool-water species research center. The objectives of the facility are to: (1) develop new production facility types and equipment; (2) formulate economical and efficient diets; (3) develop methods of intensive fish culture; and (4) study stocking results for selected species and strains stocked in various environments. During FY 1977, construction began on the main laboratory buildings and the garage/shop building. Wells were drilled. A problem developed when a higher than anticipated ground water table was encountered. As a result some redesigning was required.

National Fishery Research Laboratory, La Crosse, Wisconsin

The Fish Control Laboratory at La Crosse, Wisconsin, was established in 1959. The laboratory building was constructed during the early 1920's. The facility is being replaced by an entirely new complex known as the National Fishery Research Laboratory. The new facility will be involved in development and testing fish control methods, registration of chemicals and drugs used in fishery management, and determination of the impacts of the use of management tools on aquatic ecosystems. The administration building was completed in May 1977. Construction began on the first of two laboratories and on research ponds and water supply.

National Fish Health Laboratory, Leetown, West Virginia

The internationally-known Eastern Fish Disease Laboratory is housed in the Leetown National Fish Hatchery building. The original part of the building was constructed in 1930. Improvements were made to accommodate the laboratory, but this arrangement was never very satisfactory. Construction began on the new health laboratory in FY 1976. During FY 1977, most of the concrete masonry work was completed on the laboratory building. The target date for completion is October 1978.

Wolf Creek National Fish Hatchery, Russell County, Kentucky

Construction began on this hatchery in 1968; sporadic funding has delayed completion. When completed, annual production will be 265,000 trout weighing 75,000 pounds. The trout will be stocked in Federal reservoirs (two-story) and tailwaters and in waters on the Daniel Boone National Forest. During FY 1977, two sets of 800-foot concrete raceways were completed.

Related Program Areas

Green Lake National Fish Hatchery, Hancock County, Maine
Planning for this facility began in 1968, and construction began in FY 1972. Upon completion (FY 1979), the hatchery production capability will be 700,000 one-year Atlantic salmon smolts or 380,000 two-year smolts, or a combination. During FY 1977, footings and pipings were constructed on the hatchery building addition, 25 concrete rearing pools were completed, and work was begun on the water treatment system.

Pendills Creek National Fish Hatchery, Chippewa County, Michigan
Pendills Creek is one of three national fish hatcheries constructed for production of lake trout to assist in restoring this valuable species in the Great Lakes. The facility produces about 900,000, 5-to 6-inch lake trout annually. On December 14, 1975, fire destroyed the main hatchery building complex. During FY 1977, the remains of the burned-out structure were removed and the new structure was about half completed.

Warm Springs National Fish Hatchery, Warm Springs Indian Reservation, Wasco County, Oregon
Construction of the Warm Springs facility began in FY 1971. When completed (FY 1978), the hatchery will produce 1.5 million salmon and trout for stocking on Indian reservation waters. During FY 1977, work was completed on the holding ponds, spawning ponds, settling basin, traveling water screens, and about half of the electrical work.

Allegheny National Fish Hatchery, Warren County, Pennsylvania
Site preparation at the Allegheny National Fish Hatchery was completed during FY 1976. Facility construction began in FY 1977. The Allegheny National Fish Hatchery will produce 0.5 million 5-to 6-inch lake trout for the Great Lakes and 200,000 catchable trout for stocking in waters on the Allegheny National Forest and other waters on Federal lands in New York and Pennsylvania. During FY 1977, the raceway structures, water supply, and drainage were completed. Completion of the hatchery is scheduled for late FY 1978.

White River National Fish Hatchery, Windsor County, Vermont
Construction of the White River National Fish Hatchery began in FY 1975. This hatchery is being constructed to produce about 600,000 Atlantic salmon smolts for stocking in the Connecticut River and will contribute to the New England Atlantic salmon restoration program. During FY 1977, most of the work was completed on the water intake system and construction of the hatchery building.

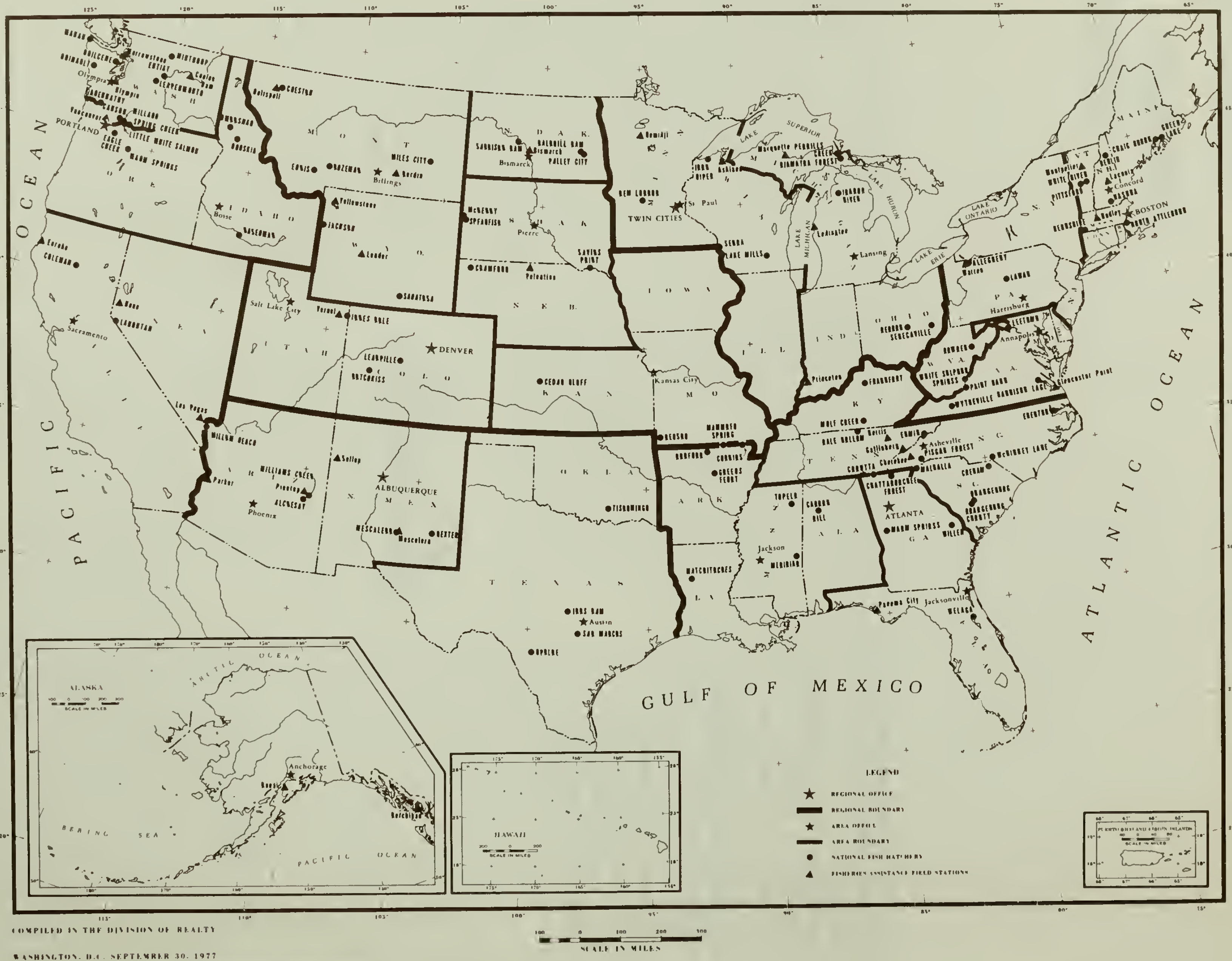
Makah National Fish Hatchery, Makah Indian Reservation, Clallam County, Washington
The Makah National Fish Hatchery, authorized in FY 1973, will produce about 11 million Pacific salmon and steelhead trout for stocking in anadromous streams on the reservation. During FY 1977, about one mile of the access road was completed.

Iron River National Fish Hatchery, Bayfield County, Wisconsin
During FY 1977, authorization was provided for the construction of a new lake trout hatchery for stocking the Great Lakes. This facility will have an annual production capability of 3.5 million trout fingerlings. Preliminary planning and design engineering were accomplished during the year.

UNITED STATES
DEPARTMENT OF THE INTERIOR

NATIONAL FISH HATCHERIES AND FISHERIES ASSISTANCE STATIONS

UNITED STATES
FISH AND WILDLIFE SERVICE



COMPILED IN THE DIVISION OF REALTY

WASHINGTON, D.C. SEPTEMBER 30, 1977

Appendix

Summary of Fisheries Assistance on Areas Served

Fiscal Year 1977

AGENCY SERVED	NUMBER OF AREAS SERVED	ACRES OF IMPOUNDMENTS (000's)	MILES OF STREAMS	HATCHERY FISH STOCKED (000's)		MAN-DAYS OF FISHING (000's)
				LBS.	NO.	
Air Force	29	1.426	38.5	44.393	217.5	378.55
Army	57	23.283	246.8	70.341	913.773	698.67
Navy & Marines	28	2.3928	204.0	14.21	137.907	155.009
National Forests	17	50.421	5,748.5	549.092	2,534.509	3,745.04
National Parks	12	135.32	5,971.0	19.336	69.300	517.579
National Wildlife Refuges	59	380.486	336.3	49.357	2,758.858	1,313.339
Veterans' Administration	21	0.276	1.0	3.835	26.513	22.704
Other Federal Areas	21	0.451	40.5	11.332	60.75	50.838
Indian Reservations	97	687.327	3,504.208	1,343.034	23,775.17	1,833.068
Federal-State Cooperative Areas	50	16.314	756.8	287.137	1,889.4	944.644
Other Public Waters	6	0.048	9.8	3.945	13.4	29.74
Private Waters	8	0.86	0.0	87.115	617.925	30.885
Totals	405	1,298.6048	16,857.408	2,483.127	33,069.005	9,720.066

Distribution of Anadromous Fish Conservation Act Funds

State Allocations for Fiscal Year 1967-77

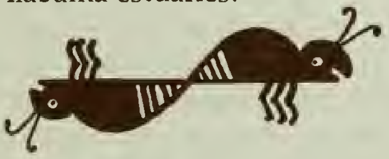
STATE	FISCAL YEAR 1967-70	FISCAL YEAR 1971-75	FISCAL YEAR 1976	FISCAL YEAR 1977	TOTAL
Alabama	20,000	113,000	17,500	20,000	170,500
Alaska	309,400	366,750	358,095	174,200	1,208,445
California	1,045,625	959,500	335,500	246,000	2,586,625
Connecticut	72,450	169,233	24,000	104,000	369,683
Delaware	136,413	235,000	31,300	29,000	431,713
Florida	30,000	60,000	–0–	–0–	90,000
Georgia	69,388	136,550	31,000	33,000	269,938
Hawaii	–0–	–0–	–0–	–0–	–0–
Illinois	5,000	20,000	10,000	10,000	45,000
Indiana	15,000	135,000	34,500	30,000	214,500
Louisiana	27,800	125,000	15,000	20,000	187,800
Maine	650,675	276,950	71,250	91,500	1,090,375
Maryland	58,022	70,500	50,000	–0–	178,522
Massachusetts	93,987	242,354	47,100	58,000	441,441
Michigan	2,140,000	1,590,000	300,000	281,500	4,311,500
Minnesota	99,314	380,700	109,000	90,300	679,314
Mississippi	55,000	87,500	17,500	17,500	177,500
New Hampshire	63,638	303,352	34,900	18,300	420,190
New Jersey	43,230	99,750	18,750	19,000	180,730
New York	155,238	773,982	551,700	696,200	2,177,120
North Carolina	31,187	145,000	70,000	87,500	333,687
Ohio	15,000	–0–	–0–	–0–	15,000
Oregon	781,520	832,732	178,000	179,000	1,971,252
Pennsylvania	67,625	308,000	150,605	120,700	646,930
Rhode Island	53,500	96,595	23,500	–0–	173,595
South Carolina	69,200	285,500	73,000	86,500	514,200
Texas	–0–	–0–	–0–	–0–	–0–
Vermont	25,525	66,482	6,800	6,800	105,607
Virginia	238,437	215,000	20,000	–0–	473,437
Washington	716,300	657,020	414,000	574,000	2,361,320
Wisconsin	396,526	1,273,550	292,000	292,000	2,254,076
TOTAL	$7,485,000	$10,025,000	$3,285,000	$3,285,000	$24,080,000

Alabama

Striped Bass Production and Stocking

FY 77 Allocation $20,000

To produce and determine tag loss and fouling and maximum stocking densities in cage rearing of striped bass fingerlings to be stocked in Alabama estuaries.



Alaska

Southeast King Salmon Investigation

FY 77 Allocation $38,300

To determine the contribution of Alaska chinook salmon stocks to southeastern Alaska fisheries and to determine the feasibility of increasing the sport catch by pond rearing and smolt stocking.

Southeast Alaska Steelhead and Searun Cutthroat Trout Investigations

FY 77 Allocation $39,800

To determine the life history of steelhead and searun cutthroat trout in the Petersburg Creek system.

Mendenhall Salmon Rearing Pond

FY 77 Allocation $59,700

To evaluate the feasibility and returns to the fishery of chinook and coho salmon and steelhead and cutthroat trout reared in a glacial outwash pond and salt water rearing pens.

Russian River Red Salmon Study

FY 77 Allocation $36,400

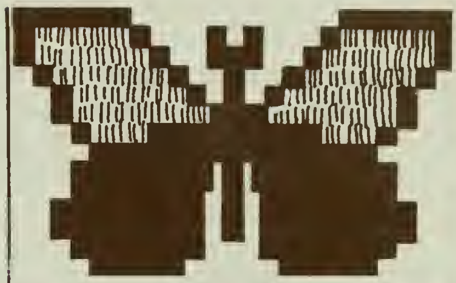
To determine escapement, reproduction and other life history facts of sockeye salmon in the Russian River system, the State's largest freshwater fishery.

California

Mad River Fish Hatchery Operations

FY 77 Allocation $85,000

To augment north coastal area fisheries for steelhead and salmon by rearing annually one million yearling steelhead and silver salmon in combination and five million king salmon (150,000 lbs. of fish).



Coastal Steelhead Study

FY 77 Allocation $57,000

To investigate ways and means of increasing the production and yield of adult steelhead in California's north coastal streams.

American Shad Study

FY 77 Allocation $54,000

To determine the life history, size of runs, distribution and utilization of American shad in the central valley.

Trinity River Anadromous Fish Study

FY 77 Allocation $50,000

To determine salmon and steelhead harvest and escapement, juvenile life history and emigration on the Klamath and Trinity Rivers and to evaluate the Trinity River Hatchery in order to determine the causes of the decline in anadromous fish runs.

Appendix

Connecticut

Connecticut River Basin Anadromous Fishery Studies

FY 77 Allocation $20,000

To determine research and management needs in the Basin and design a program to restore alewives, American shad and Atlantic salmon.

Upper Collinsville Dam Fishway

FY 77 Allocation $40,000

To construct a fishway on the Farmington River at State-owned dam to allow passage of shad, alewives and possibly Atlantic salmon. Located on the Connecticut River system near Hartford.

Lower Collinsville Dam Removal

FY 77 Allocation $40,000

State-owned dam on the Farmington River to be partially or completely removed.

Quinebaug-Thames River Study

FY 77 Allocation $4,000

Limnological and fisheries study to determine the success of introducing American shad and coho salmon.

Delaware

Delaware River Basin Studies

FY 77 Allocation $24,000

To develop the sport and commercial fisheries of the Basin with emphasis on American shad and striped bass.

Restoration of Shad Runs in Brandywine Creek and Its Tributaries

FY 77 Allocation $5,000

To restore the runs of American shad to the Brandywine stream within the States of Delaware and Pennsylvania and thereby provide an additional 30,000 man-days of recreational fishing annually.

Georgia

Enhancement of Striped Bass in Ogeechee River

FY 77 Allocation $28,000

To produce and evaluate the stocking of striped bass fry and fingerlings in the Ogeechee River.

Factors Affecting Rearing of Striped Bass Fingerlings

FY 77 Allocation $5,000

To study and improve striped bass cultural techniques.

Illinois

Lake Michigan Salmon Stocking Project

FY 77 Allocation $10,000

To purchase and stock 300,000 chinook and/or coho salmon fingerlings in Lake Michigan to provide a salmon sport fishery.

Indiana

Lake Michigan Anadromous Fish Stocking

FY 77 Allocation $30,000

To maintain the existing salmon fishery by stocking 100,000 each of coho, brown trout, and steelhead, and 200,000 chinook annually from the Kingsbury, (Mixsawba) State Fish Hatchery.

Louisiana

Striped Bass Production

FY 77 Allocation $20,000

Produce striped bass fingerlings to re-establish population in Louisiana's coastal waters.

Maine

Evaluation of Penobscot River Atlantic Salmon Restoration Program

FY 77 Allocation $23,000

Evaluate various biological characteristics of the adult runs of Atlantic salmon entering the Penobscot River.

Development of Shad and Smelt Fishery Resources

FY 77 Allocation $25,000

To restore American shad in barren coastal streams and assessment of rainbow smelt sport fishery in the Lower Kennebec and Lower Penobscot River Systems.

Evaluation of Salmon Spawning Sites and Winter Habitat

FY 77 Allocation $7,500

To assess potential Atlantic salmon spawning areas in Maine rivers to maximize use of these areas in management of this fishery.

Evaluation of Union River Fish Restoration Project

FY 77 Allocation $8,000

Evaluate adult returns of Atlantic salmon and determine their contribution to the fishery.

Penobscot River Fishway Maintenance

FY 77 Allocation $10,000

Operate and maintain 10 fishways on the Penobscot River that were constructed with PL 89-304 funds.

Survey of Coastal Atlantic Salmon Rivers

FY 77 Allocation $10,000

To conduct spawning and rearing habitat assessments of Maine's Atlantic salmon water.

Fishway Feasibility at Selected Rivers

FY 77 Allocation $3,000

To conduct fishway feasibility studies for passage of Atlantic salmon on selected rivers in Maine.

Develop Smolt Release Pond

FY 77 Allocation $5,000

To develop an Atlantic salmon smolt release pond on the Penobscot River.

Massachusetts

Connecticut River Basin Anadromous Fishery Studies

FY 77 Allocation $26,000

To determine research and management needs in the Connecticut River Basin and to design a program to restore alewives, American shad and Atlantic salmon.

Southeastern Massachusetts Shad Study

FY 77 Allocation $3,000

Evaluate an experimental shad restoration endeavor in the Agawam and Mattapoisett Rivers.

Anadromous Fishery Management

FY 77 Allocation $18,000

Continue the restoration of alewives, American smelt and American shad through rearing and stocking, fishway construction and restoration, water control regulation and stream clearance.

Appendix

Merrimack River Basin Restoration Program

FY 77 Allocation $11,000

To investigate the Merrimack River Basin in Massachusetts and New Hampshire to determine feasibility of restoring runs of anadromous fish. To coordinate and implement a restoration plan. American shad and Atlantic salmon will be reared, stocked and evaluated.

Michigan

Production of Anadromous Salmonids

FY 77 Allocation $150,000

To produce 310,000 lbs. of chinook and coho salmon and steelhead smolts at Platte River Hatchery for release into Great Lakes.

St. Joseph River Buchanan Dam Fish Ladder

FY 77 Allocation $14,500

To construct fish passage facilities over Buchanan Dam. Completion of the Berrien Springs fish ladder permits anadromous fish to ascend to the base of this dam.

Muskegon River Walleye Rearing Ponds

FY 77 Allocation $6,000

Construct a 15-acre pond capable of producing 100,000 to 150,000 walleye fingerlings annually for release into the Muskegon River.

Pine River Fish Ladder and Lamprey Barrier

FY 77 Allocation $25,000

Plan and construct a barrier that will block upstream migration of sea lamprey while not impeding the passage of anadromous fish.

Whitney Drain Lamprey Barrier of Fish Ladder

FY 77 Allocation $20,000

Plan and construct a barrier to adult sea lamprey while not impeding passage of anadromous fish on the Au Gres River.

Rifle River Sea Lamprey Barrier

FY 77 Allocation $44,000

Plan and construct a barrier to adult sea lamprey while not impeding upstream migration of anadromous fish.

Fish Passage Facilities on the Grand River

FY 77 Allocation $22,000

Plan and construct a fish ladder at Lyons Dam and the Grand River for passage of salmon and trout.

Minnesota

Improvement of Sportfishing for Anadromous Species

FY 77 Allocation $25,000

To increase the sportfishing opportunities and the quality of angling for certain anadromous fishes on streams tributary to Lake Superior, through habitat improvement and annual stocking up to 300,000 steelhead trout and coho salmon smolts.

French River Hatchery

FY 77 Allocation $65,300

Complete the construction of a fish hatchery on the French River for the production of 60,000 pounds of salmon, steelhead and lake trout for stocking in Minnesota's Lake Superior and other inland waters.

Mississippi

Rearing and Stocking of Striped Bass

FY 77 Allocation $17,500

To establish a population of striped bass which will utilize the coastal streams, estuaries and Gulf of Mexico Waters by stocking strains of bass which are known to migrate to open sea.

New Hampshire

Connecticut River Basin Anadromous Fishery Studies

FY 77 Allocation $10,300

To determine research management needs in the Connecticut River Basin, and to design a program to restore alewives, American shad and Atlantic salmon.

Coho Salmon Introductions

FY 77 Allocation $4,600

To establish a coho salmon fishery in New Hampshire's Great Bay, Little Bay, and Piscataqua River area through rearing, stocking and evaluating returns.

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Merrimack River Basin Restoration Program

FY 77 Allocation $3,400

To restore American shad and Atlantic salmon in the Merrimack River in Massachusetts and New Hampshire. Activities include planning, research and coordination.

New Jersey

Delaware River Basin Anadromous Fishery Studies

FY 77 Allocation $13,000

To develop the sport and commercial fisheries of the basin with special emphasis on American shad and striped bass.

Shad Study, Raritan River

FY 77 Allocation $6,000

To conduct surveys to determine feasibility to develop anadromous fish runs.

New York

Delaware River Basin Anadromous Fishery Studies

FY 77 Allocation $11,000

To develop the sport and commercial fisheries of the basin with special emphasis on American shad and striped bass.

Anadromous Fish Hatchery Development

FY 77 Allocation $632,000

To construct a major hatchery for production of 200,000 pounds of coho and chinook salmon, steelhead, brown and lake trout to support recreational fishing in Lake Ontario and tributaries thereto.

Anadromous Fish Enhancement in Lake Ontario

FY 77 Allocation $40,000

Complete development of plan for Lake Ontario to serve as a baseline for research and management activities. Project includes stocking of salmonids and evaluating returns.

Fish and Wildlife Management Coordination

FY 77 Allocation $12,400

To participate in the cost of the State's Federal Aid Program.

Appendix

North Carolina

Anadromous Fisheries Research, North Coast Area

FY 77 Allocation $30,000

To determine spawning times and nursery areas utilized by anadromous fish. To determine growth and movement of juvenile anadromous fish and year-class composition, movement, and utilization of adult anadromous fish. Anadromous fish species include blueback herring, alewives, striped bass, American shad, hickory shad, Atlantic and shortnose sturgeon.

Anadromous Fisheries Research, Cape Fear River

FY 77 Allocation $42,500

To conduct a detailed survey of anadromous fish and their spawning and nursery habitat for the purpose of developing sound management programs. Anadromous fish species include river herring, shad, striped bass and sturgeon.

Status and Abundance of the Striped Bass in Roanoke River and Albemarle Sound

FY 77 Allocation $15,000

Delineate the status, abundance and vital statistics for management of the Roanoke River and the fisheries.

Oregon

Effects of Logging on Salmonids

FY 77 Allocation $10,000

Measure environmental changes in coho salmon and sea-run cutthroat trout spawning and rearing areas during and following logging to determine influence of environmental changes on fish populations. Management of effects of resultant temperature fluctuations on cutthroat trout is also included.

Nehalem River Winter Steelhead Study

FY 77 Allocation $11,000

Determine means and measures for maximizing the contribution of hatchery fish to the fishery.

Streamflow Requirements of Salmonids

FY 77 Allocation $35,000

Develop techniques that can be used in natural streams to estimate the influence of stream discharge on anadromous fish production.

Genetic Study of Anadromous Salmonids

FY 77 Allocation $40,000

To determine genetic characteristics, potential for change, and comparison of hatchery and wild steelhead.

Genetic Study of Anadromous Salmonids

FY 77 Allocation $33,000

To determine genetic characteristics, potential for change, and comparison of hatchery and wild steelhead.

Butte Falls Hatchery Pollution Abatement

FY 77 Allocation $25,000

To reduce hatchery effluent discharge by construction of a waste treatment pond at Butte Falls Hatchery and improve hatchery water supply.

Design of Coastal Hatchery

FY 77 Allocation $25,000

To renovate and expand Rock Creek Hatchery.

Pennsylvania

Delaware River Basin Anadromous Fishery Studies

FY 77 Allocation $33,800

To develop sport and commercial fisheries of the basin with special emphasis on American shad and striped bass.

Restoration of Shad Run in Brandywine Creek and its Tributaries

FY 77 Allocation $1,900

To restore runs of anadromous fishes to the Brandywine stream within the States of Delaware and Pennsylvania and thereby provide an estimated additional 30,000 man-days of recreational fishing annually.

Establishment and Maintenance of Pacific Salmon in Pennsylvania Waters of Lake Erie

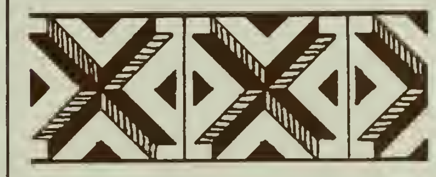
FY 77 Allocation $80,000

To establish chinook salmon and maintain populations of coho and chinook salmon in Lake Erie at a level which will provide a high quality sport fishery through the hatching, rearing and stocking of coho and chinook salmon.

Shad Restoration Project on Schuylkill and Lehigh River

FY 77 Allocation $5,000

To conduct surveys of needs of implement program of shad restoration.



South Carolina

Detail Studies of the Santee and Cooper Rivers

FY 77 Allocation $36,500

To obtain biological, chemical and physical data on the anadromous species in the Santee and Cooper Rivers.

Enhancement of Striped Bass Populations in Santee River

FY 77 Allocation $50,000

Stock striped bass fingerlings in Santee River and assess their survival.

Vermont

Connecticut River Basin Anadromous Fishery Studies

FY 77 Allocation $6,800

To determine research and management needs in the basin and to design a program to restore alewives, American shad and Atlantic salmon.

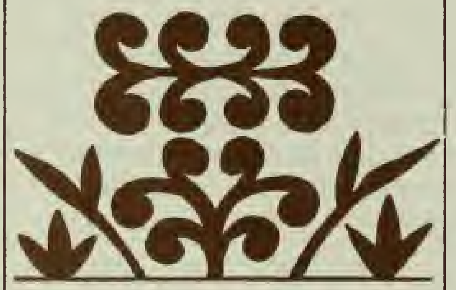
Appendix

Washington

Operation and Maintenance of Anadromous Fish Ponds

FY 77 Allocation $117,000

To operate ponds constructed with P.L. 89-304 funds to provide for the production of over 1½ million steelhead migrants to supplement native populations in heavily fished waters within the Boldt Decision Case Area.



Development of Anadromous Fish Catch Record System

FY 77 Allocation $66,500

To develop a computerized system for instantaneous daily estimates of the steelhead and salmon harvest to assure proper sharing of fish with Indians and to provide adequate escapement for perpetuation of the runs. The system also includes storage and retrieval of hard data (fish tickets).

Green River Rearing Pond No. 2

FY 77 Allocation $100,000

To expand the rearing station constructed under AFS-10 for the production of steelhead smolts to augment the sport and Indian fishery in the Green River.

Lower Johns Creek Rearing Ponds Construction

FY 77 Allocation $203,000

For development of two earthen ponds with appurtenant facilities in Southern Puget Sound to facilitate the production of 50,000 pounds of chum salmon fry and 100,000 of chinook salmon for the augmentation of the sport, commercial and Indian fisheries within the Boldt Decision Case Area.

Bear Springs Rearing Pond

FY 77 Allocation $87,500

For the construction of a 3 acre rearing pond adjacent to the Soleduck River on the Olympic Peninsula to rear 50,000 steelhead and 100,000 spring chinook salmon smolts. The project will be jointly operated by the Washington Department of Fisheries and Game to benefit sport, commercial and Indian fisheries within the Boldt Decision Case Area.

Wisconsin

Anadromous Fishery Enhancement

FY 77 Allocation $292,000

To produce sufficient fish for Wisconsin's Lake Superior and Lake Michigan to satisfy sport fishing demands. Brook, brown, and rainbow trout and chinook and coho salmon (over 2.5 million fry) will be stocked. Stock assessment work will be conducted.